INSTALLATION RESTORATION PROGRAM

Preliminary Assessment

151st Air Refueling Group
Utah Air National Guard
Salt Lake City International Airport
Salt Lake City, Utah

and

299th Communications Flight
Utah Air National Guard
Francis Peak Radar Station
Francis Peak, Utah

November 1989

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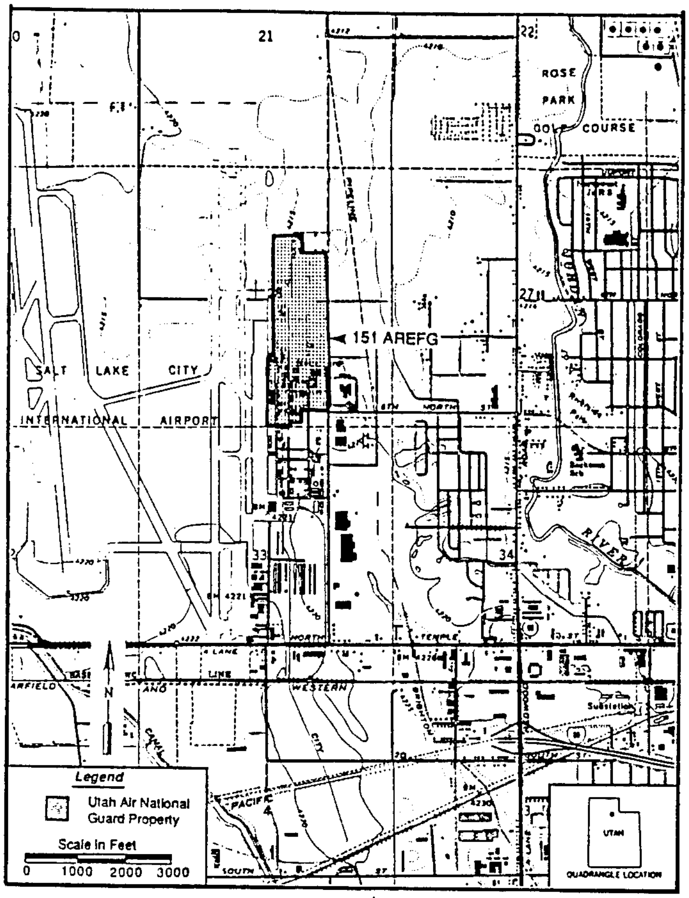

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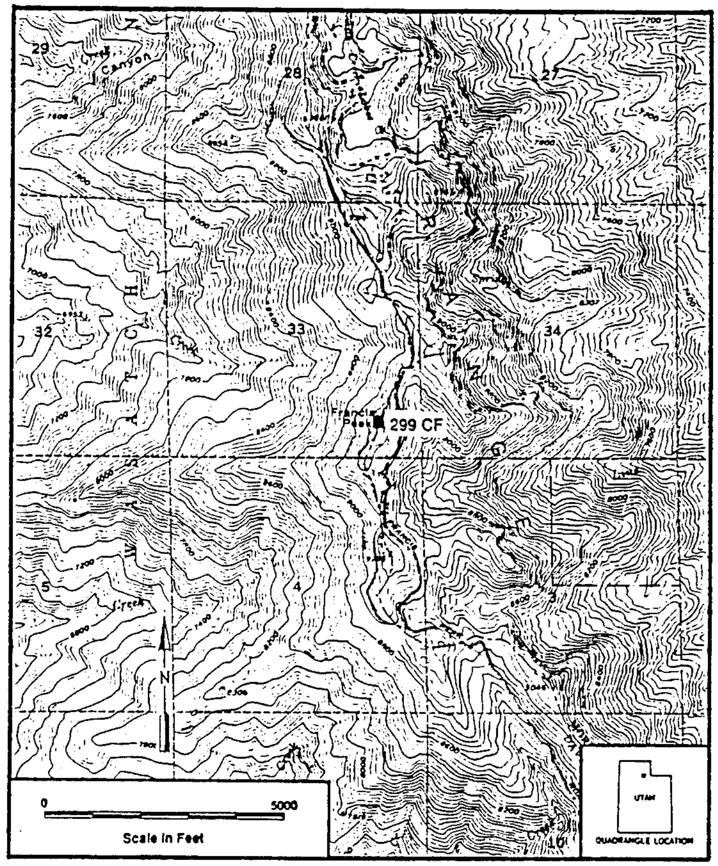

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INSTALLATION RESTORATION PROGRAM
PRELIMINARY ASSESSMENT

151st AIR REFUELING GROUP
UTAH AIR NATIONAL GUARD
SALT LAKE CITY INTERNATIONAL AIRPORT
SALT LAKE CITY, UTAH

and

299th COMMUNICATIONS FLIGHT
UTAH AIR NATIONAL GUARD
FRANCIS PEAK RADAR STATION
FRANCIS PEAK, UTAH

November 1989

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ABS	-	Air Base Squadron
AC&W	-	Aircraft Control and Warning
AFG	-	Air Fighter Group
AGE	-	Aerospace Ground Equipment
ANG	-	Air National Guard
AREFG	-	Air Refueling Group
ATV	-	All Terrain Vehicle
CAMS	-	Consolidated Aircraft Maintenance Squadron
CEF	-	Civil Engineering Flight
CES	-	Civil Engineering Squadron
CRP	-	Control and Reporting Post
DRMO	-	Defense Reutilization and Marketing Office
EIS	-	Electronics Installation Squadron
EPA	-	Environmental Protection Agency
FACP	-	For-ward Air Control Post
FBS	-	Fighter Bomber Squadron
FS	-	Fighter Squadron
FR	-	Federal Register
FTA	-	Fire Training Area
GEEIA	-	Ground Electronics Engineering Installation Agency
HARM	-	Hazard Assessment Rating Methodology
HAS	-	Hazard Assessment Score
HM/HW	-	Hazardous Materials/Hazardous Wastes
HMTC	-	Hazardous Materials Testing Center
IRP	-	Installation Restoration Program
MEK	-	Methyl Ethyl Ketone
NDI	-	Non-Destructive Inspection
NOAA	-	National Oceanic and Atmospheric Administration
OWS	-	Oil Water Separator
PA	-	Preliminary Assessment
PCB	-	Polychlorinated Biphenyl
PE	-	Professional Engineer
PG	-	Professional Geologist
POC	-	Point of Contact
POL	-	Petroleum, Oil, and Lubricant
RD/RA	-	Remedial Design/Remedial Action
RD&D	-	Research, Development, and Demonstration
SAC	-	Strategic Air Command
SI/RI/FS	-	Site Investigation/Remedial Investigation/Feasibility Study
TCF	-	Tactical Control Flight
TCS	-	Tactical Control Squadron
TFG	-	Tactical Fighter Group
TTF	-	Tow Target Flight
USAF	-	United States Air Force
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey
UST	-	Underground Storage Tank

FOREWORD

This Preliminary Assessment (PA) document was originally prepared for the National Guard Bureau (NGB) by the Hazardous Materials Technical Center (HMTC), operated by the Dynamac Corporation. HMTC's contract for conducting PAs ended prior to completion of the final PA document. Subsequently, the NGB requested completion of this PA under an existing contract with the Hazardous Waste Remedial Actions Program (HAZWRAP) Support Contractor Office, operated by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy. In turn, HAZWRAP subcontracted with Science and Technology, Inc. for completion of the PA document. Science and Technology, Inc. successfully completed this document in November 1989.

Science and Technology, Inc. produced the final document primarily by addressing comments generated by the NGB through review of HMTC draft documents. Since HMTC conducted the PA and prepared the original PA manuscript, the content of this document is principally a reflection of HMTC's efforts.

EXECUTIVE SUMMARY

A. Introduction

The Hazardous Materials Technical Center (HMTC) was retained in September 1987 to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the 151st Air Refueling Group, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah, (hereinafter referred to as the Base) and the 299th Communications Flight, Utah Air National Guard, Francis Peak Radar Station, Francis Peak, Utah, (hereinafter referred to as the Radar Station). This work was performed under Contract No. DLA 900-82-C-4426. The Preliminary Assessment included:

- an on-site visit, including interviews with 17 past and present Base and Radar Station employees conducted by HMTC personnel during May 16-20, 1988;
- the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the Base and Radar Station;
- the acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- the identification of sites on the Base and Radar Station that are potentially contaminated with hazardous materials/hazardous wastes (HM/HW).

B. Major Findings

BASE:

Past Base operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of the Base that use and dispose of HM/HW include Nondestructive Inspection (NDI); Fuels Management; Vehicle Maintenance;

Photography Laboratory; Field Maintenance; Corrosion Control; Fire Department; Clinic; Aircraft Maintenance; Weapons; Engine Shop; and Aerospace Ground Equipment (AGE) Maintenance. Waste solvents, oils, cleaners, lead bromate, fuel, battery acid, ethylene glycol, thinner, fluids, photographic chemicals, and inspection chemicals are generated by these activities.

Interviews with past and present Base personnel and a field survey resulted in the identification of disposal and/or spill sites at the Base. The following sites are potentially contaminated with HM/HW and were assigned a Hazard Assessment Score (HAS) according to the U.S. Air Force Hazard Assessment Rating Methodology (HARM):

Site No. 1 - Pesticide Dump

An area south of 2nd Street between E and F Streets is suspected of being used as a pesticide dump site. No precise information exists on its contents, the exact amount of material in the site, or the time frame of the dump site's use.

Site No. 2 - Waste POL Spill near Building 1527

This site is adjacent to the south side of Building 1527. The 106th/109th Tactical Control Flight (TCF) AGE Shop has a 200-gallon bowser for waste oil, solvents, and fuel. In 1987, the bowser leaked due to a valve failure. The exact amount spilled is unknown. The spill was cleaned up. During the site visit, the area appeared to have residual staining from the spill.

Site No. 3 - Drum Burial

At a point located approximately 1000 feet north-northwest of the corner of C Street and 9th Street and immediately south of the current off-base fire training area, six drums may have been buried. The drums reportedly contained "off spec" JP-4 and waste solvents. These drums were crushed and covered with dirt. The crushed drums were reportedly removed in 1984. During the site visit, no evidence of drum burials or contamination was seen because the area had been graded.

Site No. 4 - Fire Training Area (FTA) 1

From 1947 to 1972, the Base operated an FTA at a location approximately 300 feet northeast of the Motor Pool's parking shed. This location was verified by photographs. The standard procedure was to burn 300 to 500 gallons of fuel; however, at times as many as 1200 to 1500 gallons of fuel and unknown flammables were used. During the site visit, no evidence of the FTA was found.

Site No. 5 - Fire Training Area (FTA) 2

From 1973 to 1975, another FTA was located approxiately 500 feet northeast of the intersection of C Street and 9th Street. It lies within the boundaries of the new lease area.

The standard procedure was to burn 150 gallons of JP-4. This FTA was only used two or three times. At the time of the site visit, the area was covered by fill and vegetation.

Site No. 6 - Ramp Washdown

This large, elongate site is situated in the grassy area along the west edge of the flight ramp. Numerous fuel and oil spills have occurred on the ramp, especially during the 1950s and 1960s when the Base had aircraft that leaked oil. The oil was washed off into the adjacent grass. During the site visit, no vegetative stress was seen.

Site No. 7 - Oil Sludge Pond

From the 1950s until 1972, an oil sludge pond was located approximately 150 feet north and slightly east of the Motor Pool's parking shed. This location is in the current parking lot situated north of the Motor Pool.

Waste oil, paints, and solvents were probably disposed of here. This pond was reportedly cleaned up prior to construction of the Motor Pool.

RADAR STATION:

Past Radar Station operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of the Radar Station that use and dispose of HM/HW include Vehicle Maintenance and Field Maintenance. Waste diesel fuel, Stoddard solvent, trichloroethane, paint, thinner, and denatured alcohol are generated by these activities.

An interview with the present Radar Station operator and a field survey resulted in the identification of no disposal and/or spill sites at the Radar Station that are potentially contaminated with HM/HW.

C. Conclusions

BASE:

Information obtained through interviews with past and present Base personnel resulted in the identification of seven areas on the Base that are potentially contaminated with HM/HW. The potential exists for contamination of soils, surface water, or groundwater and subsequent contaminant migration at the following sites:

Site No. 1 - Pesticide Dump

Site No. 2 - Waste POL Spill near Building 1527

Site No. 3 - Drum Burial

Site No. 4 - Fire Training Area (FTA) 1

Site No. 5 - Fire Training Area (FTA) 2

Site No. 6 - Ramp Washdown

Site No. 7 - Oil Sludge Pond

Each of these sites was therefore assigned a HAS according to HARM.

RADAR STATION:

Information obtained through an interview with a present Radar Station employee resulted in the

identification of no areas on the Radar Station that are potentially contaminated with HM/HW.

D. Recommendations

BASE:

Further IRP investigation is recommended for the following sites:

Site No. 1 - Pesticide Dump

Site No. 2 - Waste POL Spill near Building 1527

Site No. 3 - Drum Burial

Site No. 4 - Fire Training Area (FTA) 1

Site No. 5 - Fire Training Area (FTA) 2

Site No. 6 - Ramp Washdown

Site No. 7 - Oil Sludge Pond

RADAR STATION:

No further IRP investigation is recommended.

I. INTRODUCTION

A. Background

The 151st Air Refueling Group, Utah Air National Guard, located at Salt Lake City International Airport, Salt Lake City, Utah (hereinafter referred to as the Base), uses KC-135E aircraft to provide refueling support to the Strategic Air Command (SAC). The 299th Communications Flight, Francis Peak Radar Station, Francis Peak, Utah (hereinafter referred to as the Radar Station), provides radar alert warning protection.

Past operations at the Base and Radar Station involved the use and disposal of materials and wastes that subsequently were categorized as hazardous. Consequently, the National Guard Bureau has implemented its Installation Restoration Program (IRP). The IRP consists of the following:

- Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.

- Site Investigation/Remedial Investigation/ Feasibility Study (SI/RI/FS) - to acquire data via field studies for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment and to select a remedial action through preparation of a feasibility study.

- Research, Development, and Demonstration (RD & D) - if needed, to develop new technology for accomplishment of remediation.

- Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement site remedial action.

B. Purpose

The purpose of this Preliminary Assessment is to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites,

and spill sites on the Base and Radar Station. Personnel from the Hazardous Materials Technical Center (HMTC) visited the Base and Radar Station, reviewed existing environmental information, analyzed Base and Radar Station records concerning the use and generation of hazardous materials/hazardous wastes (HM/HW), and conducted interviews with past and present Base and Radar Station personnel familiar with past hazardous materials management activities. A physical inspection was made of the suspected sites. Relevant information collected and analyzed as a part of the Preliminary Assessment included the history of the Base and Radar Station; local geologic, hydrologic, and meteorologic conditions that may affect migration of contaminants; local land use; public utilities that could affect the potential for exposure to contaminants; and the ecologic settings that indicate environmentally sensitive habitats or evidence of environmental stress.

C. Scope

The scope of this Preliminary Assessment is limited to the Base and Radar Station and includes:

- An on-site visit;
- The acquisition of pertinent information and records on hazardous materials use and hazardous wastes generation and disposal practices at the Base and Radar Station;
- The acquisition of available geologic, hydrologic, meteorologic, land use, critical habitat, and utility data from various Federal, State, and local agencies;
- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions.

The on-site visit and interviews with past and present Base and Radar Station personnel were conducted during May 16-20, 1988. The Preliminary Assessment was conducted by Ms. Natasha Brock, Task Manager/Environmental Scientist; Ms. Betsy Briggs, Hazardous Waste Specialist; and Mr. Raymond Clark, PE/Department Manager. Other HMTC personnel who assisted with the

Preliminary Assessment included Mr. Mark Johnson, PG/ Program Manager; and Ms. Janet Emry, Hydrogeologist (Appendix A). Personnel from the Air National Guard Support Center who assisted in the Preliminary Assessment included Mr. Don Williams, Project Officer. The Point of Contact (POC) at the Base was Lt. Col. Frank Johnson, Base Civil Engineer.

D. Methodology

A flow chart of the Preliminary Assessment Methodology is presented in Figure 1. This methodology ensures a comprehensive collection and review of pertinent, site-specific information and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The Preliminary Assessment begins with a site visit to the Base and Radar Station to identify all shop operations or activities on the installation that may use hazardous materials or generate hazardous wastes. Next, an evaluation of both past and present HM/HW handling procedures is made to determine if any environmental contamination has occurred. The evaluation of past HM/HW handling practices is facilitated by extensive interviews with past and present employees familiar with the various operating procedures at the Base and Radar Station. These interviews also define the areas on the Base and Radar Station where any HM/HW, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or otherwise released into the environment.

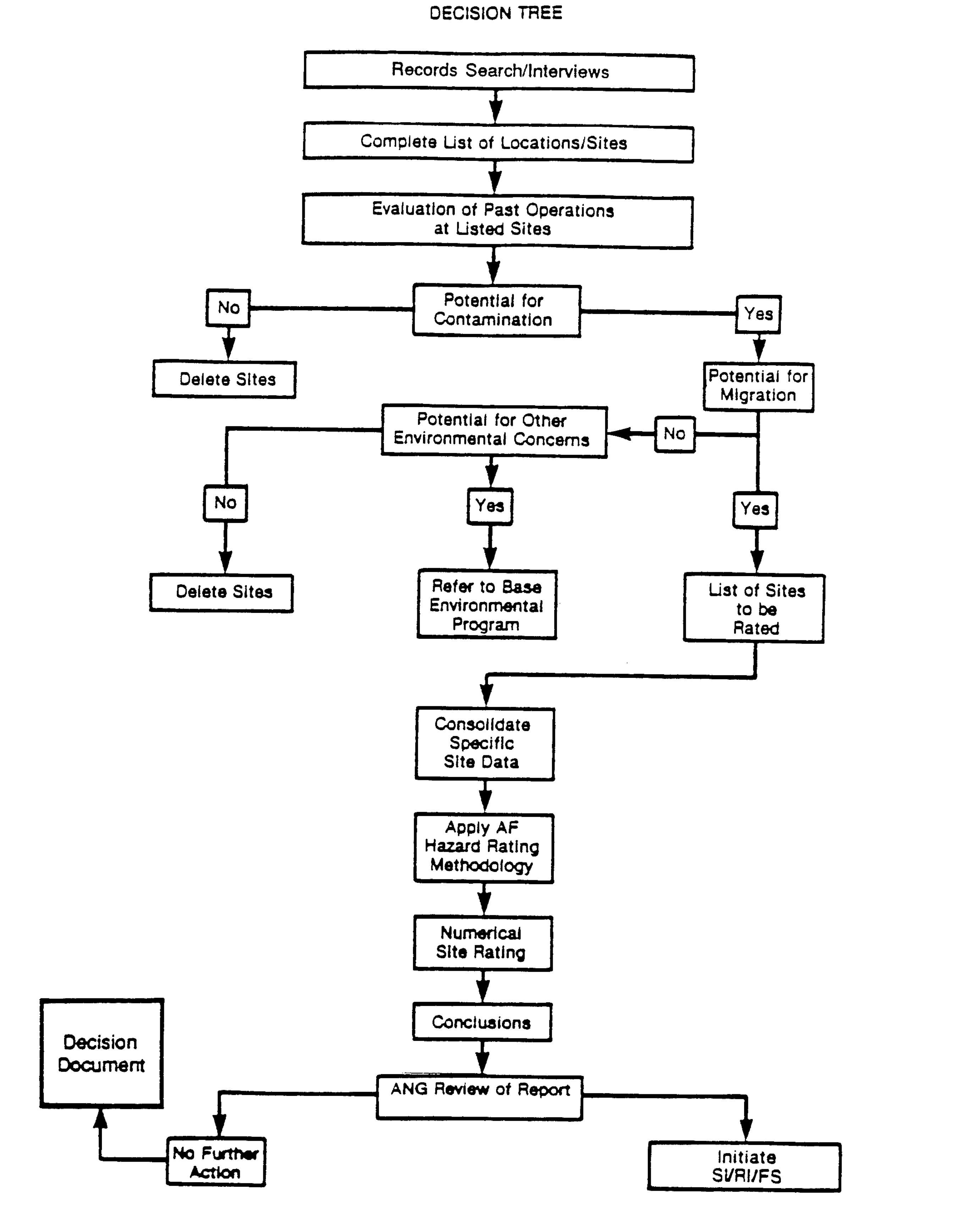
Historic records contained in the Base and Radar Station files are collected and reviewed to supplement the information obtained from interviews. Using this information, a list of past waste spill/disposal sites on the Base and Radar Station is generated. These potential sites are subject to further evaluation. A general survey tour of the identified sites, the Base and Radar Station, and the surrounding area is conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration. Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells.

Detailed geologic, hydrologic, meteorologic, land use, and environmental data for the area of study is also obtained from the POC and from appropriate Federal,

PRELIMINARY ASSESSMENT
INSTALLATION
RESTORATION PROGRAM

Figure 1.

Preliminary Assessment Methodology Flow Chart.



State, and local agencies. A list of outside agencies contacted is in Appendix B. Following a detailed analysis of all the information obtained, areas are identified as suspect where HM/HW disposal and/or spills may have occurred. Where sufficient information is available, sites are assigned a Hazard Assessment Score (HAS) using the U.S. Air Force Hazard Assessment Rating Methodology (HARM) (Appendix C). However, the absence of a HAS does not necessarily negate a recommendation for further IRP investigation, but rather, may indicate a lack of data. The HAS is computed from the data included in the Factor Rating Criteria. (Appendix D).

II. INSTALLATION DESCRIPTION

A. Location

BASE:

The 151st Air Refueling Group (AREFG), Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah is located on the east side of the airport. The airport is located northwest of the city and southeast of Salt Lake, specifically Township 1 North, Range 1 West, Section 28. Figure 2A shows the location of the Base.

The area surrounding the Base consists of airport operations to the north, west, and south and residences to the east. The residential area is moderately populated with persons who live in single family homes and garden style apartments. The population within 1000 feet of the Base is calculated using the Salt Lake City, Utah North Quadrangle, 1975 topographic map (to count residential property) and assuming each dwelling unit has 3.8 residents (47 FR 31233). The residential population is 15, and the Base personnel population is 300, therefore, giving a total population of 315.

RADAR STATION:

The Radar Station is located at the top of Francis Peak (elevation 9,547 feet) in the Wasatch Range, specifically Township 4 North, Range 1 East, Section 33. Figure 2B shows the location of the Radar Station.

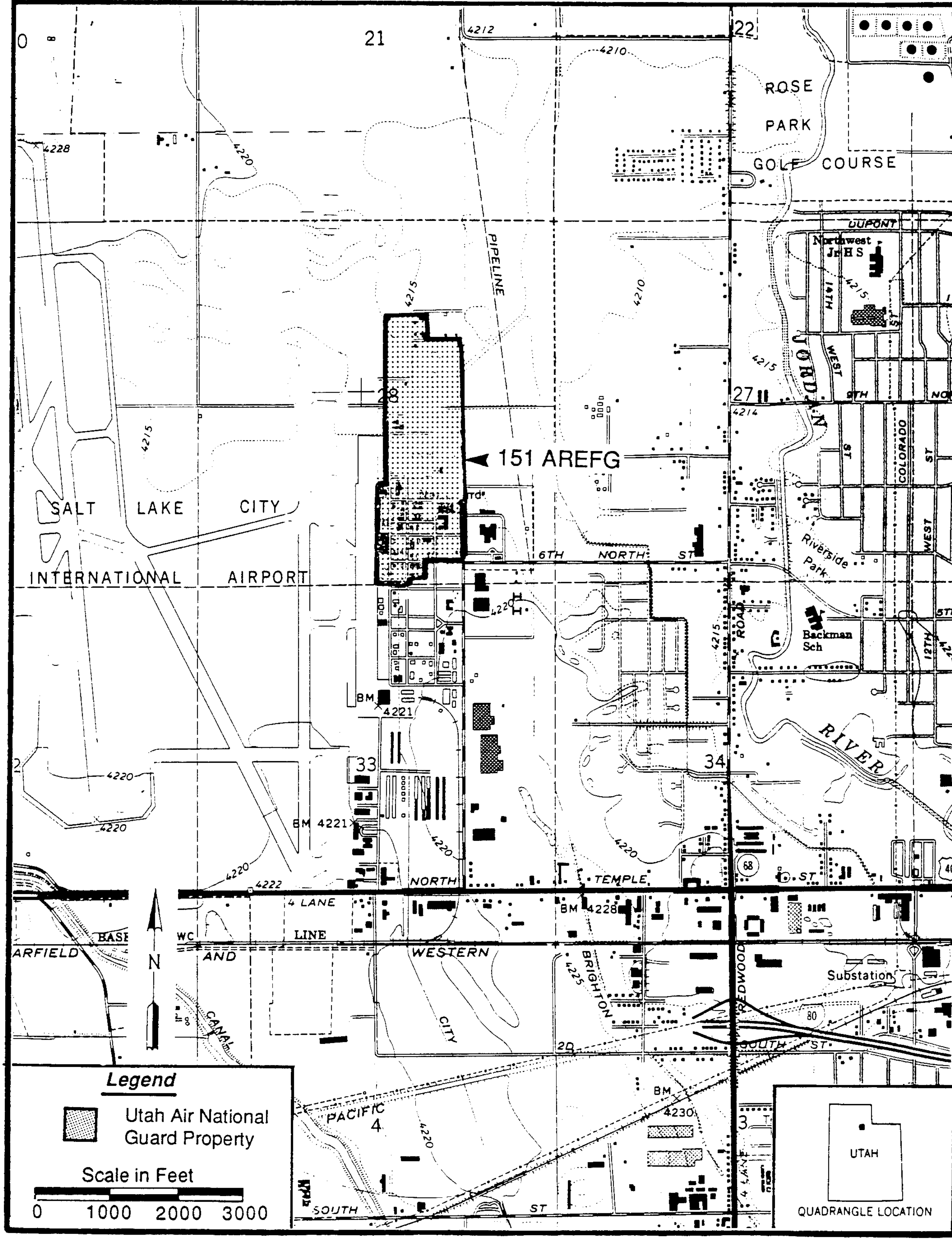
The area surrounding the Radar Station is steep, mountainous terrain covered with forest. Several creeks start within a 1-mile radius of the Radar Station. The population within 1000 feet of the Radar Station is calculated using the Peterson Quadrangle, 1975 topographic map (to count residential property) and assuming each dwelling unit has 3.8 residents (47 FR 31233). The residential population is zero, and the Radar Station personnel population is three, therefore, giving a total population of three.

HMTC

Source: USGS Topographical Map 7.5 Minute Series Salt Lake City North, Utah, 1963, Photorevised 1969 and 1975.

Figure 2A.

Location Map, 151 AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah

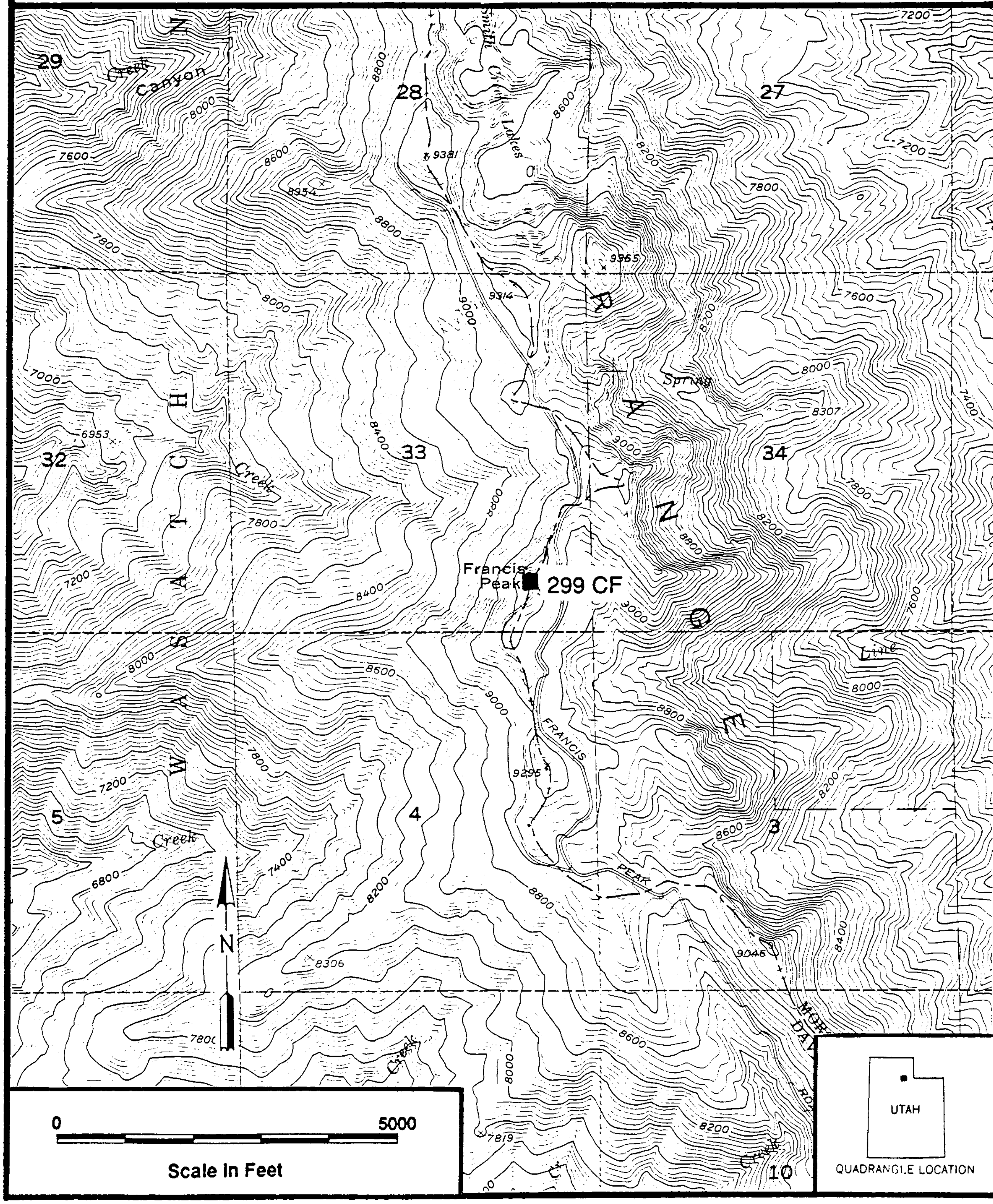


HMTC

Source: USGS Peterson Quadrangle, Utah, 7.5 Minute Series Topographic Map.

Figure 2B.

Location Map, 299 CF, Utah Air National Guard, Francis Peak Radar Station, Francis Peak, Utah



B. Organization and History

The Air Guard was established in June 1946 and was named the 191st Fighter Bomber Squadron (FBS). It was equipped with F-51, C-47, and T-6 aircraft. The 244th Air Service Group was also formed to provide Base services.

In 1951 the unit was organized into the 130th Aircraft Control and Warning (AC&W) Flight and the 210th TOW Target Flight (TTF) with B-26 aircraft. Along with the 191st Fighter Squadron (FS), they were sent into active duty. In 1953, all units but the 210th TTF returned to the State.

In 1953 the unit was redesignated as the 191st Fighter Bomber Squadron and assigned F-51H aircraft. The 8191st and 8192nd Replacement Training Squadrons were also organized to allow training simultaneously.

In 1955 the unit was reorganized into a fighter interceptor squadron with F-86A jet aircraft. In 1958 the squadron received F-86L jet aircraft.

During 1956 through 1959, the Francis Peak Radar site was constructed.

In August 1957, the 151st Air Fighter Group (AFG), 151st Consolidated Aircraft Maintenance Squadron (CAMS), 151st Air Base Squadron (ABS), and 151st USAF Dispensary received Federal recognition.

In 1961 the unit was reorganized in conjunction with a mission change involving an aircraft conversion from jet fighters to transport aircraft. The unit was organized as the 151st Support Squadron and was equipped with C-97 Stratofreighter aircraft.

During the late 1960s, the unit was reorganized from the Air Transport Group to the Military Airlift Command and received C-124C aircraft. Also, the 130th AC&W Squadron became the 130th Ground Electronics Engineering Installation Agency Squadron (GEEIA), and the 299th Communications Flight was organized.

During the early 1970s, the 130th GEEIA was reorganized as the 130th Electronics Installation Squadron (EIS), and the 106th Tactical Control Squadron

(TCS) was organized as the Control and Reporting Post (CRP) and Forward Air Control Post (FACP).

The 106th Tactical Control Flight was organized in 1971 and currently resides on Base property.

In 1972 the unit was reorganized from the Military Airlift Command to the Tactical Air Command, thus replacing the C-97 and C-124 with KC-97L aircraft.

In 1976 the 151st AREFG became a member of the Strategic Air Command (SAC) and received KC-135 Stratotanker jet aircraft.

During the early 1980s, the Engineering Installation Squadron (EIS) was redesignated as the 130th EIS. The 151st AREFG converted to KC-135E aircraft.

In 1986 the 151st Civil Engineering Flight (CEF) was redesignated as the 151st Civil Engineering Squadron (CES).

III. ENVIRONMENTAL SETTING

A. Meteorology

BASE:

The meteorological data presented in this section is from local climatological data compiled by the National Oceanic and Atmospheric Administration (NOAA) for the Salt Lake City, Utah area. The climate of Salt Lake City is continental semiarid with moderately cold to cold winters and hot summers. The average annual temperature is generally in the low 50s in the valleys and the upper 40s in the mountain areas. Most precipitation is from winter snowstorms in the mountains. The amount of rain varies from one area to another.

The average snowfall ranges between 40 and 50 inches in the lower valley and up to 70 inches in the foothills. Precipitation is relatively light during the summer and early fall. Storms are more frequent in the spring.

The annual precipitation consists of 14 inches of rainfall and snowfall. Calculating the net precipitation according to the method outlined in the Federal Register (47 FR 31224), a net precipitation value of 12 inches per year is obtained by subtracting the mean annual lake evaporation (2 inches) from the annual precipitation (14 inches). Maximum rainfall intensity, based on a 1-year, 24-hour rainfall, is 1.25 inches (47 FR 31235).

RADAR STATION:

The meteorological data presented in this section are from local climatological data compiled by NOAA for the Morgan Valley Area of Utah. The climate of the Francis Peak area is continental semiarid. The average annual precipitation is over 40 inches. The principal rainfall season extends from October to May, when storms from the Pacific Ocean frequent the region. Snowfall can range from 50 to 120 inches per year.

In the mountainous areas, wind flow is erratic. From weak pressure gradients, the dominant wind flow is up and down the canyons.

The average annual temperature in Morgan, Utah (located 5 miles to the east) is 45.4°F. The summer temperature usually ranges from 45°F to 85°F. Winter temperatures normally range from 13°F to 34°F.

B. Geology

BASE:

According to the Utah Geological and Mineralogical Survey, Bulletin 69, the geology of the Salt Lake City, Utah area consists of rocks from the Precambrian Period. These are the Farmington Canyon Complex, Little Willow Formation, Big Cottonwood Formation, Mineral Fork Tillite, and Mutual Formation.

The Farmington Canyon Complex consists of ancient sediments that have been metamorphosed to gneiss and schist. The rocks are intertwined with quartz and feldspar (see Figure 3A).

The Little Willow Formation consists of white, tan, or pale greenish-gray, gneissic quartzite and brown or dark greenish-gray schist. The beds contain pebbles or cobbles that have been elongated. After the beds were deposited, but before they were folded, diabase or gabbro sills and dikes intruded the beds. The dikes and sills were transformed into amphibolite. The layers were subjected to strong folding and recrystallization.

The Big Cottonwood Formation consists of quartzite that ranges in color from pinkish or white near the base, greenish or gray in the medial part, to white or tan near the top. Cross-bedding, mud cracks, shale flake conglomerates, and ripple marks are present throughout.

The Mineral Fork Tillite is a massive black or dark gray rock consisting of boulders, cobbles, and pebbles of quartzite, limestone, or granitic rock scattered in a matrix of angular, sand-size fragments. This formation is of glacial origin and is deposited in two basins, one in Mill B North Fork of Big Cottonwood Canyon and one in Mineral Fork.

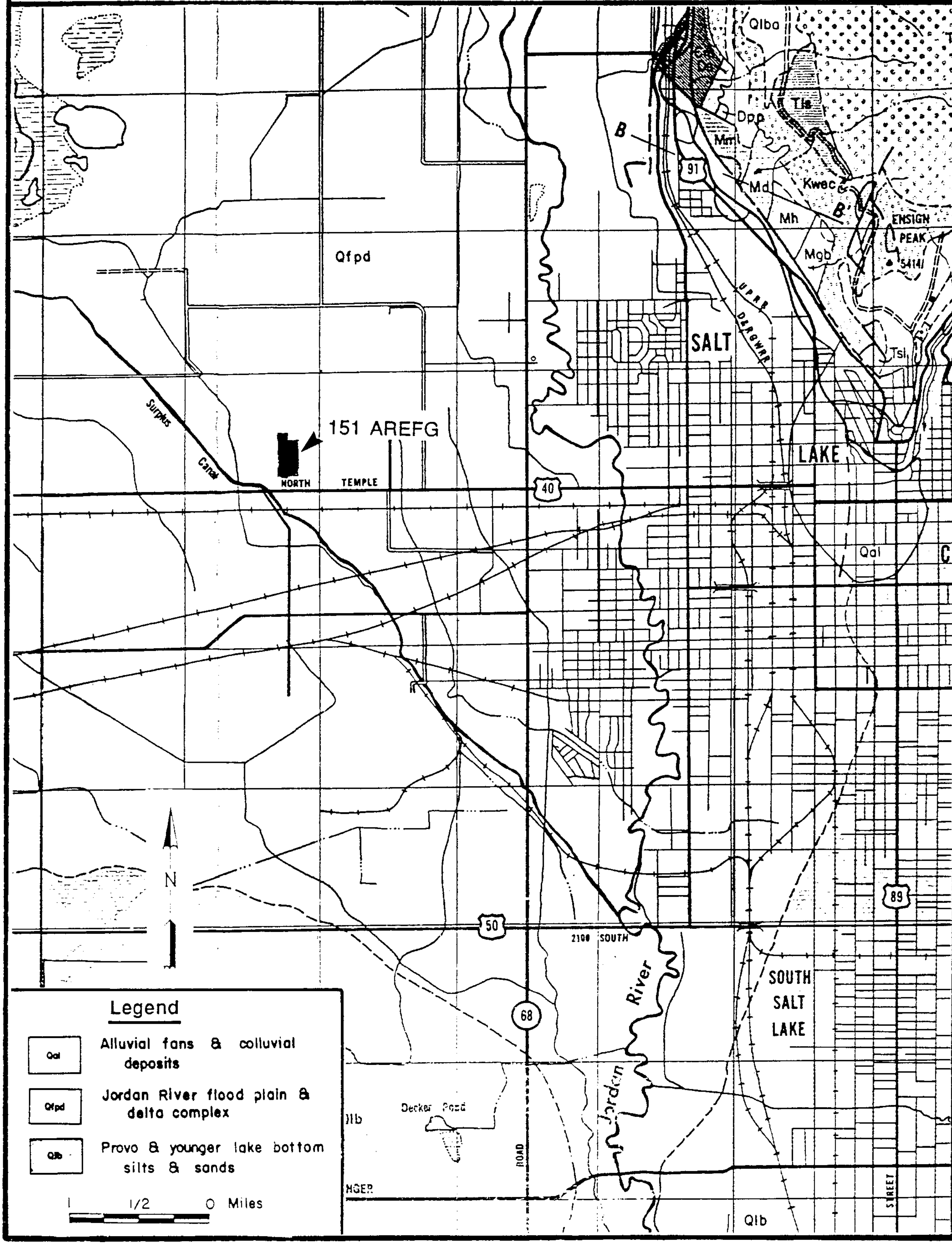
The Mutual Formation consists of grayish-red or purplish-red quartzite and shale. This formation rests on the shale of the Big Cottonwood Formation west of Mount Olympus; however, to the east, the Mutual Formation

HMTC

Source: Geological and Mineralogical Survey Univ. of Utah June, 1960.

Figure 3A.

Geologic Map of Salt Lake City, Utah.



rests on the tillite. There is evidence of erosion both before and after deposition of the tillite due to the coarsening of the Mutual Formation. After the Mutual Formation was deposited, the area was tilted and eroded into a plain.

During the Paleozoic Era, the area became submerged under a sea. The site of Salt Lake City rests on a line that separates two different provinces: to the west, a long depositional trough, the Cordilleran geosyncline, and to the east, a stable platform. The geosyncline allowed sediments to accumulate to a thickness of two to eight miles.

The first deposits into the Cordilleran geosyncline were of Cambrian age. These deposits consist of quartz-sand ranging in thickness from 1000 to 3000 feet and form the Tintic Quartzite. As the shoreline receded eastward, the deposition changed to mud and calcareous ooze, which are now represented by the shale and thin limestones of the Ophir Formation and the Maxfield Limestone. The Ophir Formation is 400 feet thick, and the Maxfield Limestone ranges from 1 to 1000 feet thick.

During the Devonian Period, a huge uplifting of the Salt Lake City area occurred. During this uplift, previously deposited rocks were eroded and redeposited as the Stansbury Formation. Lithologically, the Stansbury is a conglomerate and sandstone. The area was covered again by seas and subsequent deposition of calcareous mud resulted in the formation of the Pinyon Peak Limestone.

During the Mississippian Period, a lime mud was deposited throughout the region. This mud is now a dark gray, fossiliferous limestone or dolomite and forms the Gardison and Desert Limestones, which total 1000 feet in thickness. These are overlain by the Humbug Formation, consisting of limestone interbedded with sandstone.

The rock formations of the Late Mississippian and Early Permian Periods consist of the Weber Canyon Facies and the Oquirrh Mountain Facies. These formations are found in the Wasatch Range and Oquirrh Mountains. They consist of shales, limestones, chert, and quartzite.

During the Triassic Period, the Salt Lake City area emerged and became a semiarid flood plain where red or purple mud accumulated. This mud was lithified into the Woodside and Ankareh Formations. The Woodside is shale,

and the Ankareh is shale and siltstone. The Ankareh is underlain by a basal conglomerate. These rocks are exposed in Red Butte Canyon. East of Vernal, the Thaynes Formation lies between the Ankareh and Woodside Formations. The Thaynes Formation consists of limestone.

During the Jurassic Period, an 800-foot thick accumulation of pale orange sand known as the Nugget Sandstone was deposited. Another transgression of the sea from the west deposited limy ooze and mud that now constitute the Twin Creek Limestone. Also, a dark red mud, now the red shale of the Preuss Sandstone, accumulated in salty estuaries or lagoons.

The Cretaceous section within the Salt Lake City area consists of a thick sequence of sedimentary rocks. Cretaceous formations in ascending stratigraphic sequence include the Kelvin, Frontier, Wanship and Almy. These formations were deposited in marine and terrestrial environments. Tectonic uplifts and erosional unconformities affected sedimentary deposition.

The Kelvin Formation consists of a thick sequence of limestones, sandstones, and shales. This formation is subdivided into two members: the Parley's Member (lower member), which consists of white nodular limestone and lavender shale, and an upper member, which consists of reddish brown siltstone and sandstone interbedded with conglomerate.

The overlying Frontier Formation consists of pale tan or yellowish-brown sandstones. These rocks were deposited in a terrestrial deltaic complex.

Tectonic uplift occurred after the Frontier Formation was deposited. This uplift resulted in sea regression and an erosional unconformity. Previously deposited, flat-lying rocks were tilted, weathered, and eroded. Sediments that were eroded from these rocks were redeposited and lithified as the Wanship Formation. The Wanship is a conglomerate that is composed of limestone and sandstone fragments.

A second unconformity occurs at the top of the Wanship Formation. This unconformity separates the Wanship from the overlying Almy Formation. Like the Wanship, the Almy is a conglomerate. The Almy is distinguished from the underlying Wanship by a larger

number of limestone boulders and the presence of Precambrian quartzites, which are absent in the Wanship.

A third unconformity separates the Cretaceous Almy from younger, overlying Tertiary rocks. Intense tectonic uplift and the erosional removal of sediments resulted in Tertiary rocks directly overlying Precambrian rocks within certain areas. These Tertiary rocks consist of poorly sorted red sandstones, sandy limestone, and water-laid tuff with interbedded limestone. The presence of tuff indicates that the marine and terrestrial sediments that comprise these rocks were associated with volcanic activity. Also, volcanic rocks (mainly of andesitic composition) are exposed at numerous localities in Salt Lake County. These volcanics are believed to be Tertiary in age.

The Tertiary age Knight Formation unconformably overlies the Tertiary rocks described above. The Knight Formation is conglomeritic sedimentary rock that contains a wide variety of cobbles and boulders.

The Salt Lake area lies at two major tectonic elements: (1) An east-trending upwarp, the Uinta Mountains and (2) a north-trending, arcuate belt of folds and thrust faults. Specifically, in the immediate area (within 1 mile of the Base), there are no faults.

<u>RADAR STATION</u>:

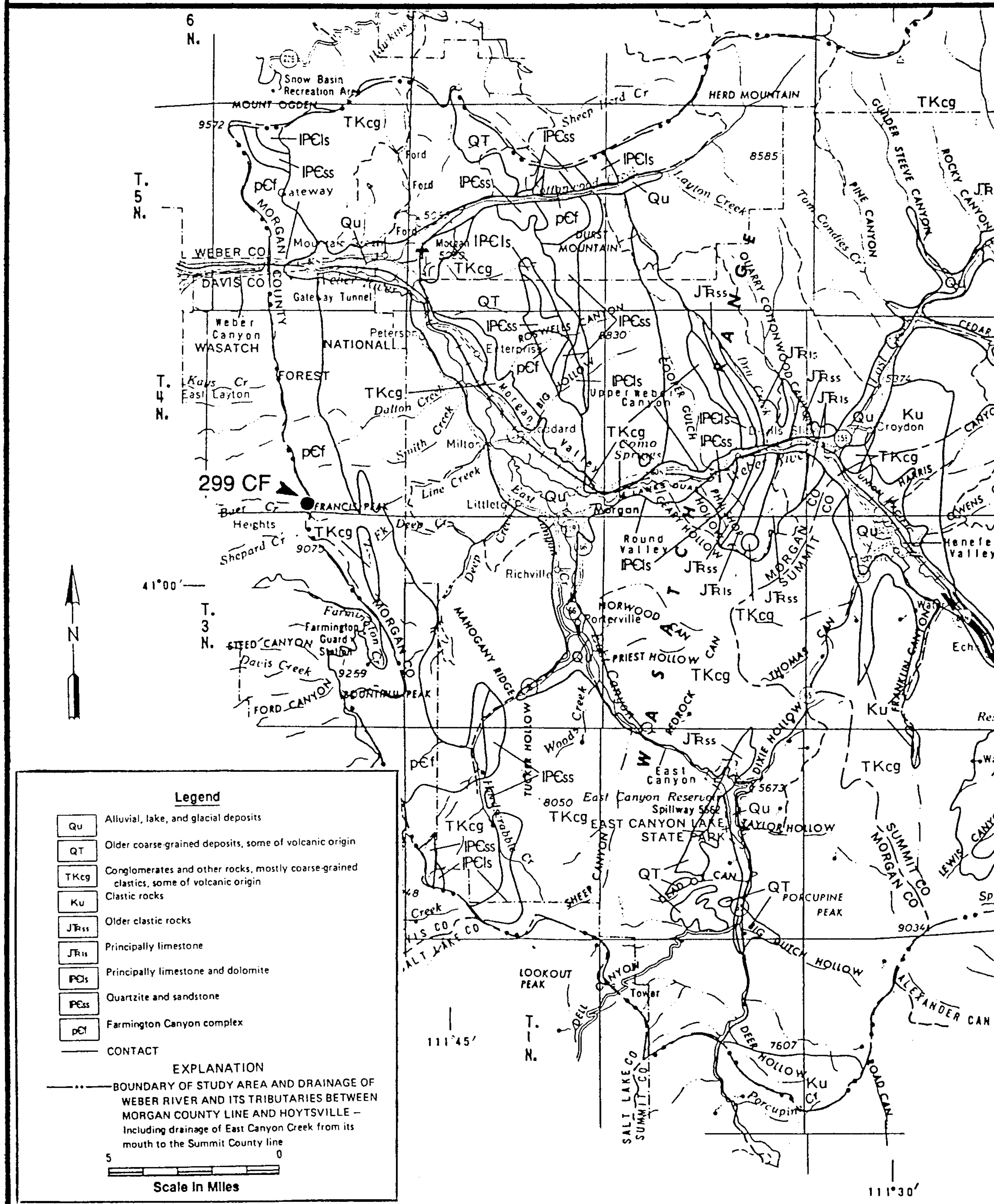
In the Wasatch Range to the northeast of the Base, there are thick sequences of sedimentary rocks of Precambrian, Paleozoic, Mesozoic, and Cenozoic age. These sequences are intruded by granitic rocks of Late Cretaceous and Early Tertiary age (Marine and Price, 1964). Figure 3B illustrates the distribution of these units at the land surface.

The Radar Station is underlain by the Precambrian Farmington Canyon Complex, which consists primarily of gneiss with some phyllite and pegmatites. This unit occurs in a narrow strip along the crest of the Wasatch Range. A conglomerate, whose age is uncertain, crops out approximately 2 miles east of the Radar Station. This unit, which also includes conglomeritic sandstones, tuffaceous sandstones, siltstones, mudstones, and limestones, occurs along the eastern slope of the Wasatch Range. Quaternary alluvium occurs along streams on both

HMTC Source: Bryant, 1984.

Figure 3B.

Geologic Map of the Wasatch Range, Utah.



the eastern and western slopes of the Wasatch Range (Marine and Price, 1964).

The Wasatch Fault Zone separates the Wasatch Range from the valley to the west. Block faulting along this fault raised the mountains, and subsequent erosion resulted in the deposition of alluvial fans that extend far out into the valley. The major structure of the Wasatch Range is a large, east-trending syncline. North and south of its axis, the rocks become progressively older (Marine and Price, 1964).

C. Soils

BASE:

Much of Salt Lake City lies on a flat valley floor. The area surrounding the Base is flat.

According to the USDA, Soil Conservation Service, the central and southern portion of the Base rests on Made land (Ma), which is a miscellaneous land type that consists of areas covered with gravel, rock, concrete blocks, and other inorganic materials. It has been built up for industrial uses and is not suited for agricultural purposes. The northern portion of the Base is underlain by the Chipman Series Chipman silty clay loam, saline-alkali (Ck) (Figure 4).

The area surrounding the Base is characterized by Chipman silty clay loam, saline-alkali (Ck) to the north; Leland fine sandy loam (Lk) to the south; Decker fine sandy loam (Da) to the east; and Lakewin sandy loam (LeA), 0 to 1 percent slope, to the west.

The Chipman series is characterized by poor drainage on river flood plains. The soil is formed in mixed alluvium from weathered sedimentary and igneous rock. The surface layer is gray silty clay loam. Underlying layers are white or light gray silty clay loam. Permeability is low (0.2 to 0.63 inches/hour), water intake is moderate (0.5 to 2.0 inches/hour), and the erosion is slight.

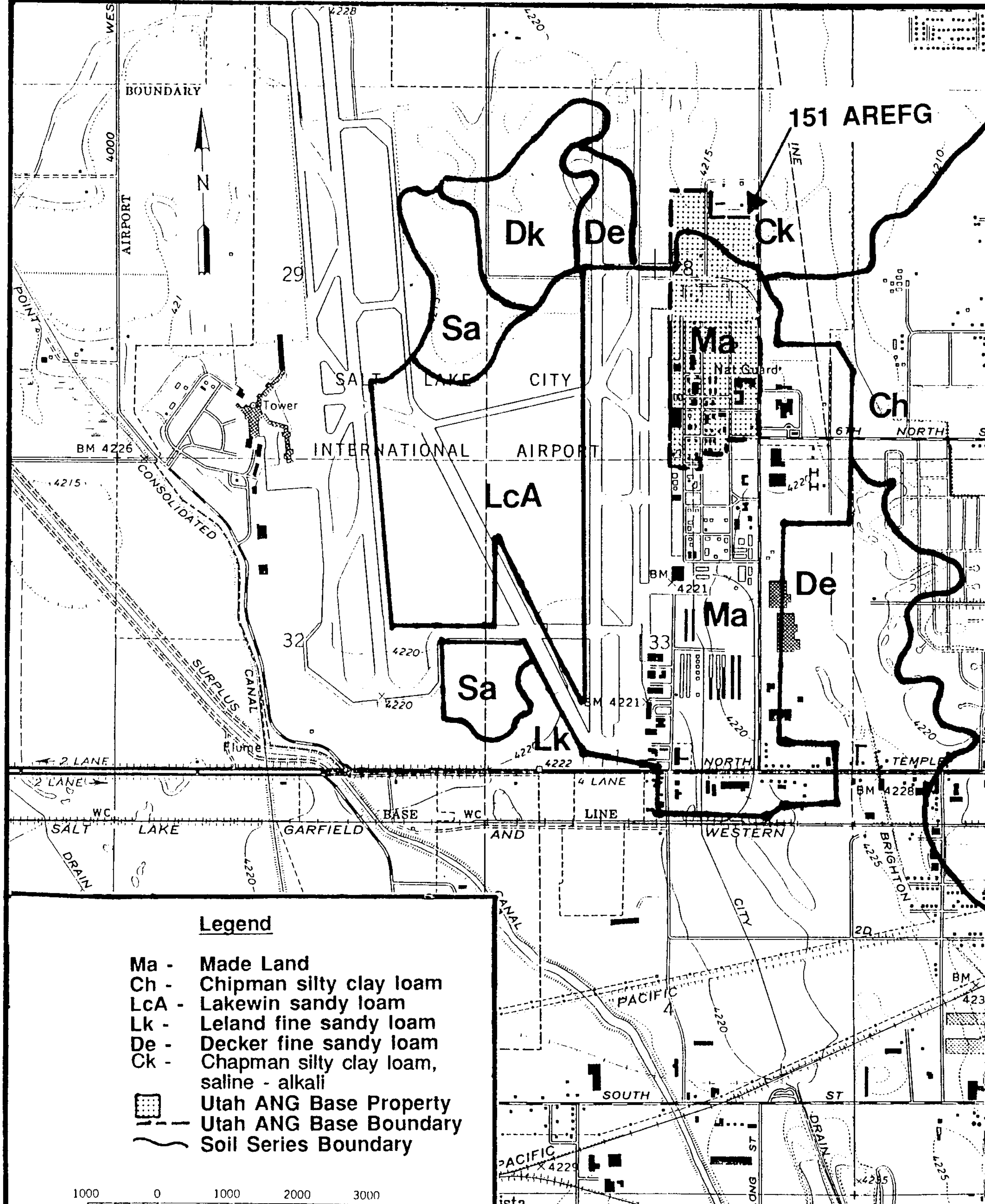
The Leland series is characterized by poorly drained saline-alkali soils that occur on lake plains. These soils are formed in calcareous, mixed lake sediments from sedimentary and igneous rocks. The surface layer is

HMTC

Source: USDA, 1974; USGS 7.5 Minute Series, Salt Lake City North, Utah, 1963. Photorevised 1975.

Figure 4A.

Soil Map of the 151 AREFG, Utah Air National Guard and Vicinity.



light brownish-gray fine sandy loam underlain by a light brownish-gray and light gray sandy clay loam. Water intake is slow, and permeability is low (0.2 to 0.6 inches/hour). Soil erosion is slight.

The Decker series consists of somewhat poorly drained soils that are moderately to strongly alkaline. These occur on lake plains, flood plains, and deltas. They originated as lake sediments and alluvium that were eroded from sedimentary and igneous rocks. The surface layer is a dark gray and light brownish gray loam that is underlain by pale brown and light gray stratified loam and sandy loam. This layer is underlain by a light gray, lake-laid, heavy silty clay loam. Water intake is moderate (0.5 to 2.0 inches/hour), and permeability is moderate (0.63 to 2.0 inches/hour). Soil erosion is moderate.

RADAR STATION:

According to the USDA, Soil Conservation Service, the soils at Francis Peak consist of Poleline stony loam (PoG), which occurs on 40 to 70 percent slopes (see Figure 4B).

The soil is deep and well-drained. It occurs on very steep and high mountainsides that are dominately north and east facing. Elevations range from 5700 to 9000 feet. The soil is formed from weathered schist, argillite, phyllite, gneiss, and quartzite.

Included in this soil are small areas of Patio gravelly loam, 40 to 60 percent slopes; Nordic gravelly loam, 30 to 60 percent slopes; Broad Canyon stony loam, 30 to 70 percent slopes; and Nagitsy stony loam, 50 to 70 percent slopes and some rock outcrops.

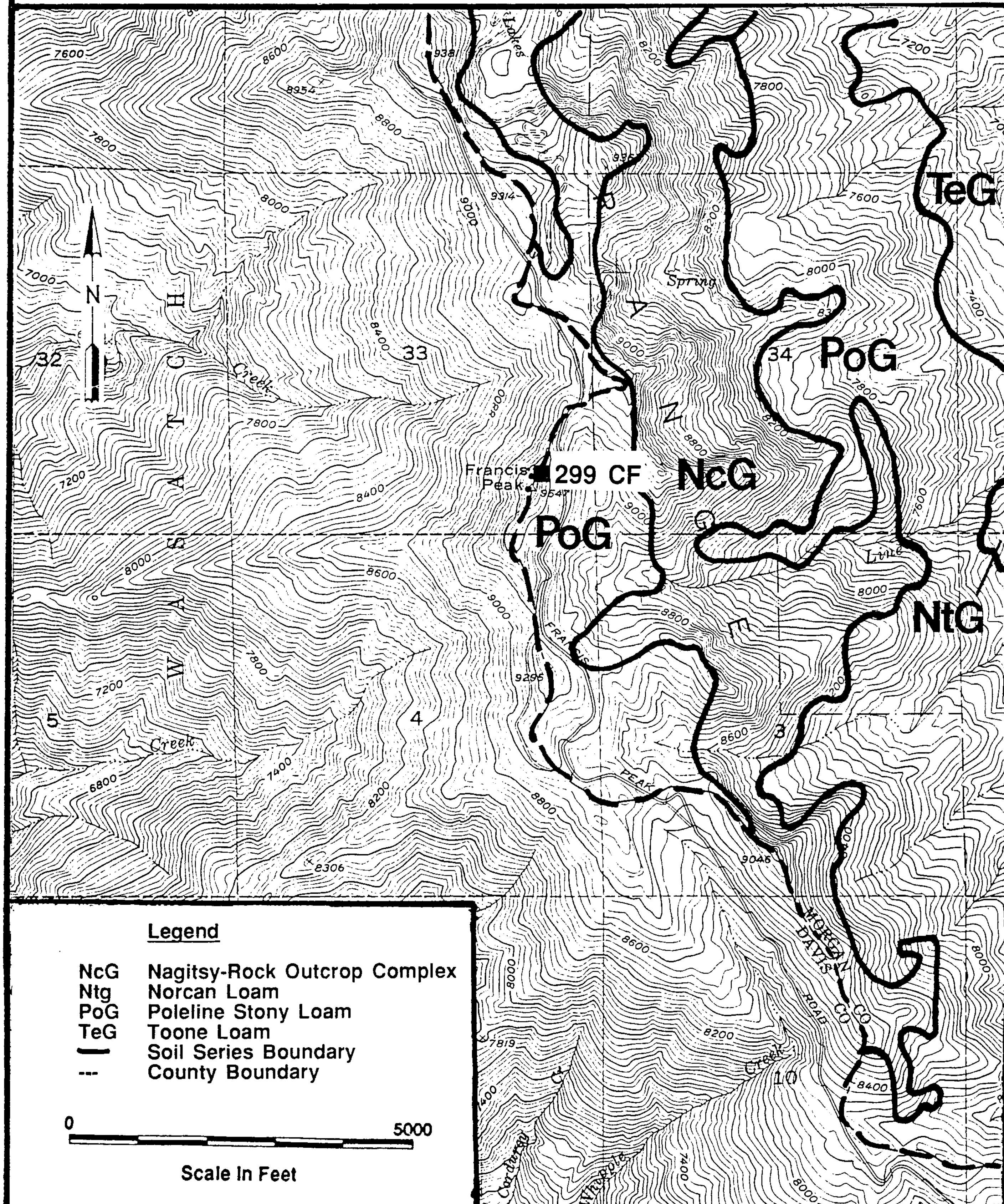
The upper portion of a typical profile is dark brown stony loam. The lower portion of the surface layer is a gravelly silt loam or gravelly loam. This surficial layer is approximately 24 inches thick. The subsoil is a dark brown, very gravelly loam approximately 24 inches thick. Fractured phyllite occurs at a depth of 48 inches. The depth to bedrock ranges from 48 inches to 60 inches. Rock fragment content is 20 percent in the surface layer and 60 percent in the subsoil.

HMTC

Source: USDA, 1980; USGS 7.5 Minute Series, Peterson, Utah, 1955. Photorevised 1975.

Figure 4B

Soil Survey of the 299 CF, Utah Air National Guard and Vicinity



Permeability is moderate (0.63 to 2.00 inches per hour), and the erosion is high.

D. Hydrology

Surface Water

BASE:

Salt Lake City obtains 20 percent of its water supply from Deer Creek Reservoir in Provo Canyon, located 45 miles southeast of the city. Another 65 percent is obtained from canyon streams in City Creek Canyon, Parley's Canyon, and Big and Little Cottonwood Canyons. In addition, there are several springs, artesian wells, and deep (250 feet to 800 feet) wells that provide about 15 percent of the city's water. These sources are located in the south and east parts of Salt Lake City.

The surface waters within a 1-mile radius of the Base consist of scattered, minor wetlands, man-made drainage features, and streams. To the east, the Jordan River runs south. To the west is the Surplus Canal and North Point Consolidated Canal. The City Drain, which originates 10 to 12 miles southeast of the Base, flows west and north to a location on the Base's southern boundary. From this location, the City Drain flows northwest and then north through Base property to the Base's former northern boundary. The City Drain then flows east along the Base's former northern boundary and after exiting the Base, continues north to the Great Salt Lake.

Surface water at the Base is collected in a series of storm drains, open ditches, and drainage swales. This surface water discharges into the City Drain at numerous outfalls. Also, the City Drain collects all the runoff from industries located upstream from the Base.

According to the Department of Natural Resources, Division of Water Rights, the Base does not lie within the 100-year flood plain of the Jordan River.

RADAR STATION:

The surface waters within a 1-mile radius of the Radar Station consist of Baer Creek to the northwest, Shepard Creek to the southwest, Fork Line Creek to the

southeast, an unnamed north trending tributary of Fork Line Creek to the northeast, and Halfway Creek to the south. The headwaters of these creeks are in the vicinity of the Radar Station; however, at this elevation, their flow is intermittent.

Groundwater

BASE:

Groundwater use in Utah varies from irrigation and public supply to industrial usage. Major focuses of groundwater development are in certain areas of the State. Salt Lake City is in one of those areas, the Salt Lake or Jordan Valley. This area produces groundwater from unconsolidated sediments (see Figure 5). These sediments may consist of boulders, gravel, sand, silt, or clay. Wells obtain the largest yields from coarser materials that are sorted into uniform grain sizes. Most wells are completed in unconsolidated deposits in large intermountain basins that have been partially filled with rock materials eroded from adjacent mountains.

Groundwater in the Salt Lake Valley occurs primarily in artesian basins. Artesian conditions are present because of two factors; an overlying confining layer and hydrological connection with shallow unconfined groundwater along the sides of the valley. Wells that are developed in these basins have potential levels that range from 5 to 10 feet above the land surface (Wilberg 1987).

Figure 6 shows a groundwater contour map of the Salt Lake Valley. The net direction of flow is north. It then splits to the east toward the Jordan River and to the west toward the Great Salt Lake. Specifically, under the Base, the groundwater flows to the east. While the data on groundwater flow direction are from 1958, there has been little change from data obtained in 1931.

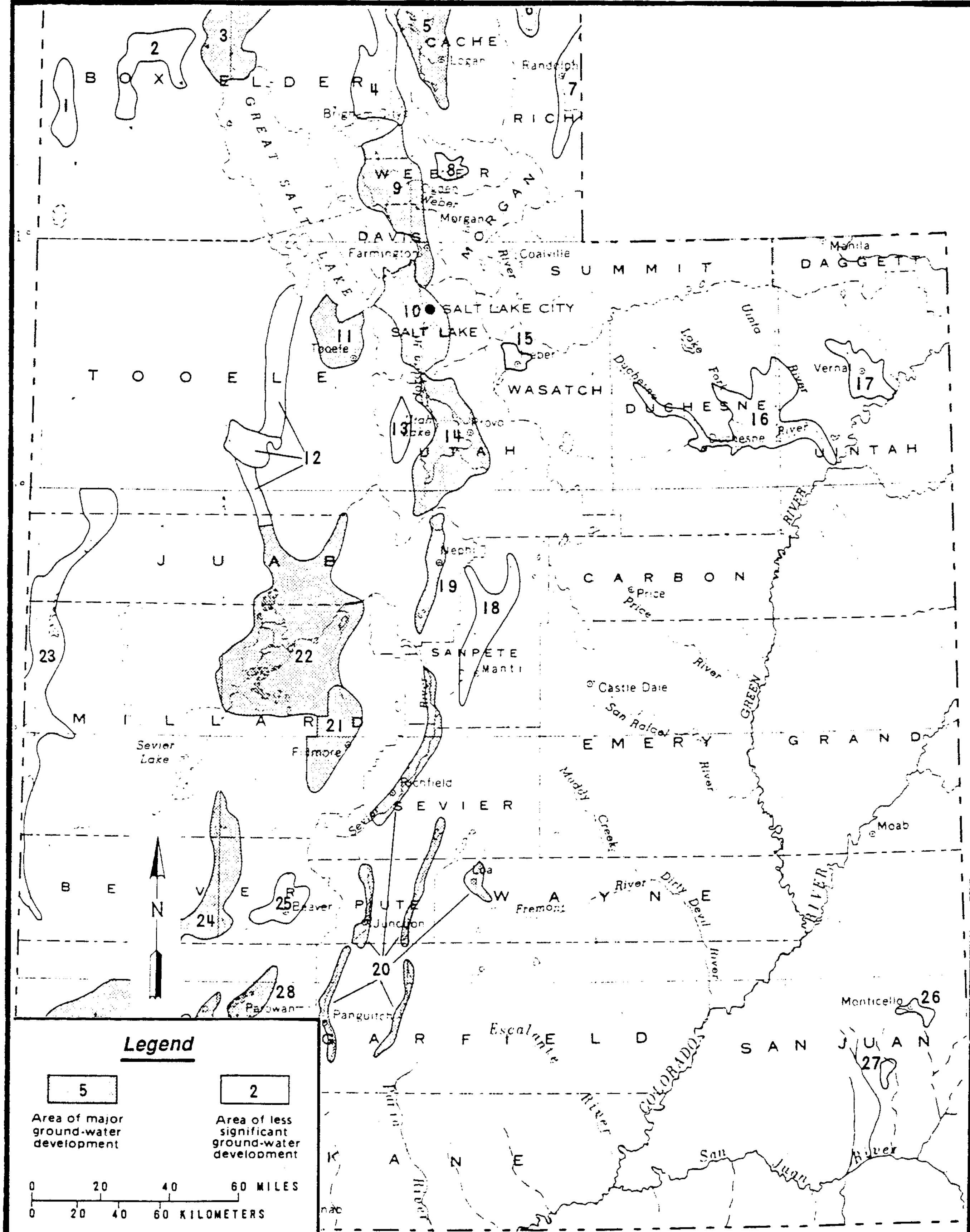
The Salt Lake Valley area yields about 46,100 acre-feet of water for public supply. Industrial usage is 34,000 acre-feet of water (Wilberg, 1987).

Recharge to the valley is by seepage from irrigated lands and canals, precipitation, creek channels, subsurface bedrock springs, and underflow from mountain canyons from the Utah Valley through the Jordan Narrows.

HMTC Source: Wilberg et al, 1987.

Figure 5.

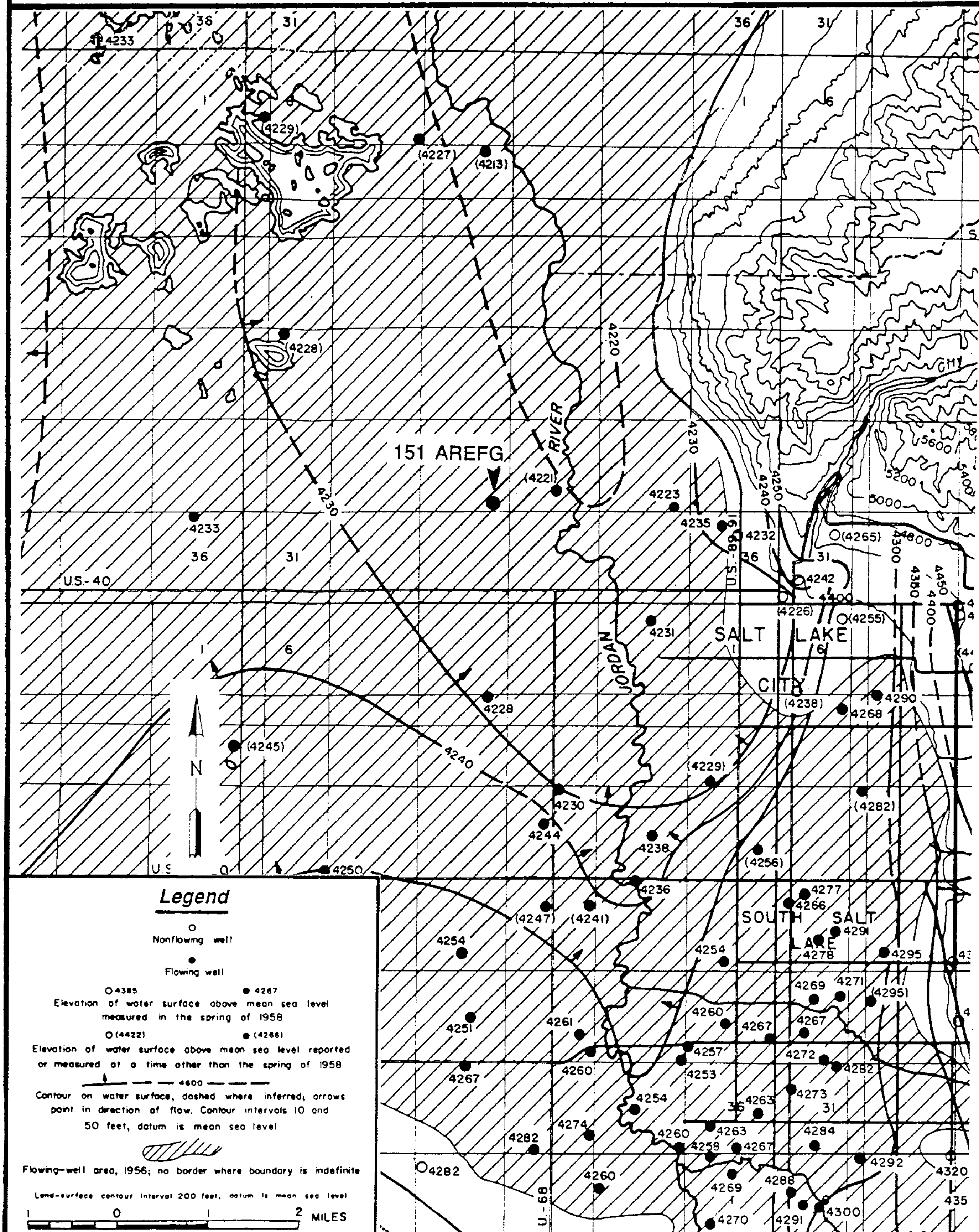
Areas of Ground Water Development in Utah.



HMTC Source: Wendell and Price, 1964.

Figure 6.

Generalized Piezometric Surface of Salt Lake City, Utah.



Discharge in the Salt Lake Valley is by evapotranspiration, nonthermal springs and seeps, thermal springs, wells, and drains. In the vicinity of the Base, the City Drain serves as a point of discharge.

The quality of the groundwater in the vicinity of the Base is poor, having more than 1000 ppm of dissolved solids. This water is generally suitable for irrigation, but only with proper management.

According to the Utah Department of Natural Resources, Division of Water Rights, there are 36 wells within a 1-mile radius of the Base. These wells are located mostly to the east. They are multi-purpose wells, supplying water for drinking, irrigation, and livestock.

Within the Base boundaries, there are no water wells that are currently being used. However, an abandoned water well is located within the Base's newly acquired lease. (See Site Location Map on page IV-7.) Base personnel indicated that this was an artesian well (50-60 feet deep) that was formerly used for irrigation.

Currently, the well head is covered with fill dirt. Its location is indicated seasonally by the presence of wet soil.

RADAR STATION:

Specific groundwater data for the Francis Peak area is not available; however, some general assumptions, based on the nature of the soils and geology of the region, can be made. Shallow groundwater, if any, occurs within the soil and weathered metamorphic bedrock at a depth of less than 48 inches (USDA, 1980). The water-bearing characteristics of the Farmington Canyon Complex are unknown, but it probably has minimal permeability, except when jointed or fractured (USGS Miscellaneous Investigation, undated). Joints generally occur within the uppermost 300 feet; fractures associated with faulting can occur at any depth. In general, groundwater yield from wells in metamorphic rock decreases rapidly with depth.

E. Critical Environments

BASE:

According to Ruesink (1988), there are no endangered or threatened species of flora or fauna within a 1-mile radius of the Base. Two endangered avian species, *Falco peregrinus anatum* (American peregrine falcon) and *Haliaeetus leucocephalus* (American bald eagle) are known to be present in the vicinity of the Base and could transit its general area. However, the critical habitats of these species lie beyond the 1-mile radius.

Numerous minor wetland areas occur within a 1-mile radius of the Base (U.S. Fish and Wildlife Service, 1981). They are located north, south, and west of the Base. Water retention in these areas is short lived, perhaps for only one or two weeks after spring runoff or heavy rain showers. Because of human disturbance and their proximity to the airport, their use by wildlife is considered to be minor (Ruesink, 1988). Given the presence of minor wetlands within a 1-mile radius of the Base, a Factor Rating of 2 for Critical Environments is used to calculate Hazard Assessment Scores (Appendix D).

RADAR STATION

According to the U.S. Fish and Wildlife Service, there are no endangered or threatened species of flora or fauna within a 1-mile radius of the Radar Station. Furthermore, there are no critical habitats, wetlands, or wilderness areas within a 1-mile radius of the Radar Station.

IV. SITE EVALUATION

A. Activity Review

BASE:

A review of Base records and interviews with Base personnel resulted in the identification of specific operations at the Base in which the majority of industrial chemicals are handled and hazardous wastes are generated. A total of 17 past and present Base personnel with an average of 24 years experience was interviewed. These personnel were representative of Civil Engineering; Aircraft Maintenance; Field Maintenance; Vehicle Maintenance; Corrosion Control; Aerospace Ground Equipment (AGE) Maintenance; Petroleum, Oils, and Lubricants (POL) Management; Photographic Laboratory; Nondestructive Inspection (NDI); Fire Department; Weapons Shop; and Clinic. Table 1 summarizes these major operations, provides estimates of the quantities of waste generated by these operations, and describes the past and present disposal practices for the wastes. Based on information gathered, any operation that is not listed in Table 1 has been determined to produce negligible quantities of wastes requiring disposal.

RADAR STATION:

A review of Radar Station records and an interview with a Radar Station employee resulted in the identification of specific operations at the Radar Station in which the majority of industrial chemicals are handled and hazardous wastes are generated. One present Radar Station employee was interviewed. This person was familiar with Radar Station operations. Information for Table 1 is not included, since it was determined that the operations produce negligible quantities of wastes requiring disposal.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 151st AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1946 1950 1960 1970 1980 1988
Corrosion Control (continued)	MEK	12	'----------------------*---------------------'---FTA---'-D-'-R-'
Machine Shop (Structural Repair) Bldg. 23	Alodine	1	'----------------*-----------------'----------SAN-----------'-R-'
Electric Shop Bldg. 23	Potassium Hydroxide	3	'---------------------UNK---------------------'-----NEUT-SAN----'
	Engine Oil	2	'--------------*------------------'-------CONTR--------'---D---'
Clinic Mss Bldgs. 18 & 1523	Developer	3	'---UNK---'----------------------DIL SAN----------------------'
	Fixer	3	'---UNK---'----------------------DIL SAN----------------------'
	Stop Bath	3	'---UNK---'----------------------DIL SAN----------------------'
Propulsion Shop Bldg. 37	PD-680	110	'----*----'------------------CONTR--------------------'-D-'-R-'
	7808 Oil	275	'----*----'------------------CONTR--------------------'---D---'

KEY:

CONTR	-	Disposed of by a contractor.
D	-	Disposed of through the Defense Reutilization & Marketing Office (usage started in 1986)
DIL SAN	-	Disposed of through the sanitary sewer with large amounts of water.
DISC	-	Use Discontinued.
EVAP	-	Disposed of through evaporation.
FTA	-	Disposed of at fire training area.
NEUT SAN	-	Disposed of through the sanitary sewer, after neutralization.
NIE	-	Shop not in existence.
NIU	-	Material not in use.
OWS	-	Disposed of through an oil water separator.
R	-	Recycled by contract.
SAN	-	Disposed of in the sanitary sewer.
STORM	-	Disposed of through the storm sewer.
TRASH	-	Disposed of in general refuse.
UNK	-	Information not supplied or not available.
WEED	-	Disposed of by using as an herbicide on the ground.
*	-	Disposed of at fire training area, the Oil Sludge Pond, or both.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 151st AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1946 1950 1960 1970 1980 1988
Fuels Management (Bldg. No. 39)	JP-4	5,000	'------NIU-------'--------*---------'-----------FTA-------------'
	Petroleum Ether	1	'----------------*------------------'-----------FTA-------------'
Nondestructive Inspection (NDI) (Bldg. No. 2)	Penetrant	55	'----------------UNK----------------'-------CONTR-------'---D---'
	Emulsifier	55	'----------------UNK----------------'-------CONTR-------'---D---'
	Developer	55	'----------------UNK----------------'------------SAN------------'
	Fixer	10	'----------------UNK----------------'------------SAN------------'
	Trichloroethane	1	'-----------------*-----------------'----UNK----'----SAN----'-R-'
	Inspection Powder	10	'----------------UNK----------------'--------CONTR------'---D---'
	Oil	55	'-----------------*-----------------'--------CONTR------'---D---'
Corrosion Control (Bldg. No. 1608) (est'd 1978)	Solvent	200	'----------------------*--------------------'------D------'-R-'
	Thinner	100	'----------------------*--------------------'---FTA---'-D-'-R-'
	Paint Stripper	150	'----------------------*--------------------'---FTA---'-D-'-R-'
	Toluene	12	'----------------------*--------------------'---FTA---'-D-'-R-'

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DISC - Use Discontinued.
EVAP - Disposed of through evaporation.
FTA - Disposed of at fire training area.
NEUT SAN - Disposed of through the sanitary sewer, after neutralization.
NIE - Shop not in existence.
NIU - Material not in use.
OWS - Disposed of through an oil water separator.
R - Recycled by contract.
SAN - Disposed of in the sanitary sewer.
STORM - Disposed of through the storm sewer.
TRASH - Disposed of in general refuse.
UNK - Information not supplied or not available.
WEED - Disposed of by using as an herbicide on the ground.
* - Disposed of at fire training area, the Oil Sludge Pond, or both.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 151st AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1946 1950 1960 1970 1980 1988
Vehicle Maintenance (Bldg. No. 24)	Engine Oil	950	'----------*----------'------------CONTR---------------'---D---'
	PD-680	100	'----------------------EVAP-----------------'-CONTR--'-D-'-R-'
	Sulfuric Acid	140	'-------------------------NEUT-SAN----------------------------'
	JP-4	200	'------NIU--------'-----------------FTA-----------------------'
	AVGAS	150	'------FTA--------'-------NIU---------'----------DISC----------'
	Ethylene Glycol	400	'----------------------------SAN------------------------------'
	Hydraulic Fluid	170	'-----------------*----------------'---------CONTR-----'---D---'
	Transmission Fluid	75	'-----------------*----------------'---------CONTR-----'---D---'
	Paint Thinner	15	'-----------------*----------------'---------CONTR-----'-D-'-R-'
	Brake Fluid	13	'----------------SAN-------------'---------CONTR-------'---D---'
	Diesel Fuel	5	'----------------FTA-------------'---------CONTR-------'---D---'
	Varsol	50	'-----------------STORM,WEED------------------------------'-R-'
	Paint Waste	unknown	'---------------------------TRASH-----------------------------'

KEY:

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DISC	-	Use Discontinued.
EVAP	-	Disposed of through evaporation.
FTA	-	Disposed of at fire training area.
NEUT SAN	-	Disposed of through the sanitary sewer, after neutralization.
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TRASH	-	Disposed of in general refuse.
UNK	-	Information not supplied or not available.
WEED	-	Disposed of by using as an herbicide on the ground.
*	-	Disposed of at fire training area, the Oil Sludge Pond, or both.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 151st AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1946 1950 1960 1970 1980 1988
Aircraft Maintenance Flightline Fuel Systems Repair Pneudraulics Phase Inspection Repair & Reclamation (Bldg. No. 3)	PD-680	150	'-----------------*-----------------'--------CONTR-------'-D-'-R-'
	Hydraulic Oil	300	'-----------------*-----------------'--------CONTR-------'---D---'
	Engine Oil	16	'-----------------*-----------------'--------CONTR-------'---D---'
	Cleaning Compound	300	'---------------UNK-----------------'----SAN---'-----DISC------'
	Lead Bromate	residue	'-------------------TRASH---------------------'-----DISC------'
	Batteries	unknown	'----------------------NEUT-SAN-----------------------'---D---'
Aerospace Ground Equipment (AGE) (Bldg. No. 6)	Engine Oil	700	'----------------*------------------'------CONTR--------'---D---'
	JP-4	100	'-------NIU------'--------*----------'---------CONTR,FTA---------'
	PD-680	200	'----------------*------------------'---------OWS--------'-D-'-R-'
	Turbine Oil	60	'----------------*------------------'------CONTR--------'---D---'
	Battery Acid	80	'-------------------------NEUT-SAN----------------------------'
	Aircraft Cleaner	110	'--------------STORM----------------'-----------SAN------------'
	MIL 7808 Oil	6	'----------------*------------------'--------CONTR-------'---D---'
	Trichloroethylene	10	'-------UNK------'------SAN---------'-----------DISC------------'

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DIL SAN - Disposed of through the sanitary sewer with large amounts of water.
DISC - Use Discontinued.
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FTA - Disposed of at fire training area.
NEUT SAN - Disposed of through the sanitary sewer, after neutralization.
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WEED - Disposed of by using as an herbicide on the ground.
* - Disposed of at fire training area, the Oil Sludge Pond, or both.

B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

BASE:

Interviews with Base personnel and subsequent site inspections resulted in the identification of seven sites potentially contaminated with HM/HW. Figure 7A illustrates the locations of the identified sites at the Base.

Seven identified sites were assigned a HAS according to HARM (Appendix C). A summary of the HAS for each scored site is listed in Table 2. Copies of the completed Hazardous Assessment Rating Forms are found in Appendix D. The objective of this assessment is to provide a relative ranking of sites suspected of contamination from hazardous substances. The final rating score reflects specific components of the hazard posed by a specific site: possible receptors of the contamination (e.g., population within a specified distance of the site and/or critical environments within a 1-mile radius of the site); the waste and its characteristics; and the potential pathways for contaminant migration (e.g., surface water, groundwater, flooding). Descriptions of the seven sites follow:

Site No. 1 - Pesticide Dump (HAS - 56)

The area south of 2nd Street between E and F Streets was reportedly used as a pesticide dump site (Figure 7A). No information exists on the amounts, contents, or time of operation. During the site visit, no stressed vegetation was observed; however, the area had recently been graded flat.

The site was scored assuming a small release, Sax's Level 3 toxicity, a flashpoint above 200°F, polycyclic compounds and halogenated hydrocarbons, and a liquid state.

Site No. 2 - Waste POL Spill near Building 1527 (HAS - 66)

This site is adjacent to the south side of Building 1527 (Figure 7A). The 106th/109th Tactical Control Fighter (TCF) AGE Shop has a 200-gallon bowser for

Figure 7A.

Site Location Map, 151 AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah.

HMTC

Source: Lockwood, Andrews, and Newman, Inc.
Utah Air National Guard
Master Plan, CP-3, Undated.

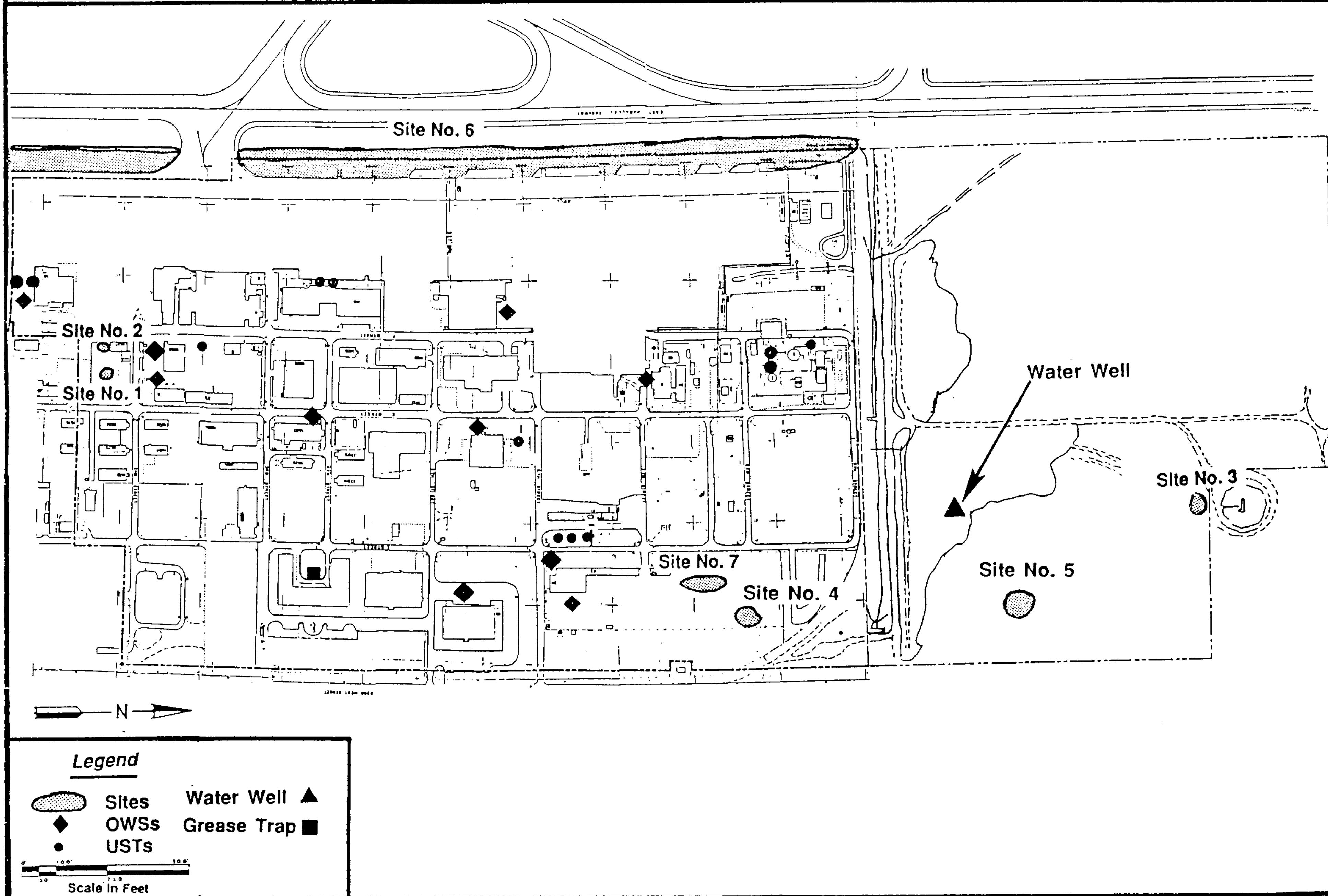


Table 2. Site Hazard Assessment Scores (as derived from HARM): 151st AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah

Site No.	Site Description	Receptors	Waste Characteristics	Pathway	Waste Mgmt Practices	Overall Scores
1	Pesticide Dump	68	40	60	1.0	56
2	Waste POL Spill near Building 1527	68	60	80	0.95	66
3	Drum Burial	68	40	60	1.0	56
4	Fire Training Area (FTA) 1	68	80	60	1.0	69
5	Fire Training Area (FTA) 2	68	60	60	1.0	63
6	Ramp Washdown	68	80	60	1.0	69
7	Oil Sludge Pond	68	80	60	1.0	69

waste oils, solvents, and fuel. In 1987 the bowser leaked due to a valve failure. The exact amount released is unknown. The spill was cleaned up and drummed for disposal. During the site visit, stained soil was observed.

The site was scored assuming a small quantity release, Sax's Level 3 toxicity, an 80^0F to 140^0F flashpoint, halogenated hydrocarbons, and a liquid state.

Site No. 3 - Drum Burial (HAS - 56)

The area adjacent to the existing fire training area (FTA) was reportedly used as a drum burial site. This site is located approximately 1000 feet north-northwest of the corner of C Street and 9th Street and immediately south of the current FTA (Figure 7A). Approximately six drums containing "off spec" JP-4 and waste solvents were crushed by bulldozer until flattened. Approximately 6 inches of dirt cover was placed over the drums. During the site visit, no signs of contamination could be found due to grading of the present FTA. No vegetation was present in the area.

The site was scored assuming a small quantity release, Sax's Level 3 toxicity, 80^0F to 140^0F flashpoint, metals, polycyclic compounds and halogenated hydrocarbons, and a liquid state.

Site No. 4 - Fire Training Area (FTA) 1 (HAS - 69)

The Base operated an FTA from 1947 to 1972 at a location approximately 300 feet northeast of the Motor Pool's parking shed (Figure 7A). The Base was the sole user of this FTA and conducted exercises once per year. During the site visit, the FTA could not be visually located due to grading.

The normal practice was to burn 300 to 500 gallons of fuel, extinguish, and reburn (giving a maximum 70% consumption). However, at times as much as 1200 to 1500 gallons of fuel and other types of flammable liquids were used, including Varsol, kerosene, and solvents (Sax's level 3). The flashpoint of some of these compounds is less than 80^0F, and their structure consists of halogenated hydrocarbons.

Site No. 5 - Fire Training Area (FTA) 2 (HAS - 63)

The Base operated a second FTA (north of 9th Street) from 1973 to 1975. This FTA was located approximately 500 feet northeast of the intersection of C Street and 9th Street (Figure 7A). The Base was the sole user and conducted exercises only two or three times using 150 gallons of JP-4 for each burn. The FTA was located using aerial photographs. During the site visit, the area could not be detected due to grading and equipment/vehicle coverage.

The site was scored assuming a small quantity release, Sax's Level 3 toxicity, less than 80°F flashpoint, straight chain hydrocarbons, and a liquid state.

Site No. 6 - Ramp Washdown (HAS - 69)

This site is situated in the grassy area along the west edge of the flight ramp (Figure 7A). Numerous fuel and oil spills have occurred on the ramp, especially during the 1950s and 1960s when the Base had C-/KC-97, F-86, and C-124 aircraft, which leaked large quantities of oil. The oil was washed off into the adjacent grass area. Photographs seen during the site visit showed the ramp to be heavily stained black. No vegetative stress was observed during the site visit.

The site was scored as a moderate quantity release with Sax's Level 3 toxicity, a flashpoint at 80°F to 140°F, halogenated hydrocarbons, and a liquid state.

Site No. 7 - Oil Sludge Pond (HAS - 69)

The Oil Sludge Pond was located approximately 150 feet north and slightly east of the Motor Pool's parking shed (Figure 7A). Its location was determined from aerial photographs and Motor Pool blueprints. The Oil Sludge Pond was in operation from the mid-1950s until 1972. It was used to dispose of waste oil and probably other wastes, i.e. solvents, paint. The pit was reportedly removed prior to the Motor Pool construction, according to construction specifications. Details of this removal are unknown.

The site was scored assuming a moderate quantity release, a flashpoint at $80^{0}F$ to $140^{0}F$, Sax's Level 3 toxicity, metals, polycyclic compounds and halogenated hydrocarbons, and a liquid state.

RADAR STATION:

An interview with a person at the Radar Station and a subsequent facility inspection resulted in the identification of no sites contaminated with HM/HW. Figure 7B shows the layout of the Radar Station.

C. Other Pertinent Information

BASE:

The Base has 11 oil/water separators (OWSs) and 11 underground storage tanks (USTs). The USTs range in capacity from 150 gallons to 5000 gallons. The contents consist of fuels and oil (product and waste). The locations of the OWSs and USTs are shown on Figure 7A. An inventory is included as Appendix E.

In 1974 or 1975, a 500-gallon fuel spill occurred near Building 10. The fuel was cleaned up with straw to prevent migration to the City Drain. It is unknown how the straw was disposed of. All of the fuel was reportedly cleaned up.

At the 106th Radar site, 500 gallons of fuel were released due to a leak in 1978. The fuel was contained, and foam was applied to eliminate the flammability hazard. The fuel was then washed into the storm sewer.

In 1979 or 1980, a 300-gallon fuel spill occurred on the ramp. The fuel was not recovered and drained into the storm sewer.

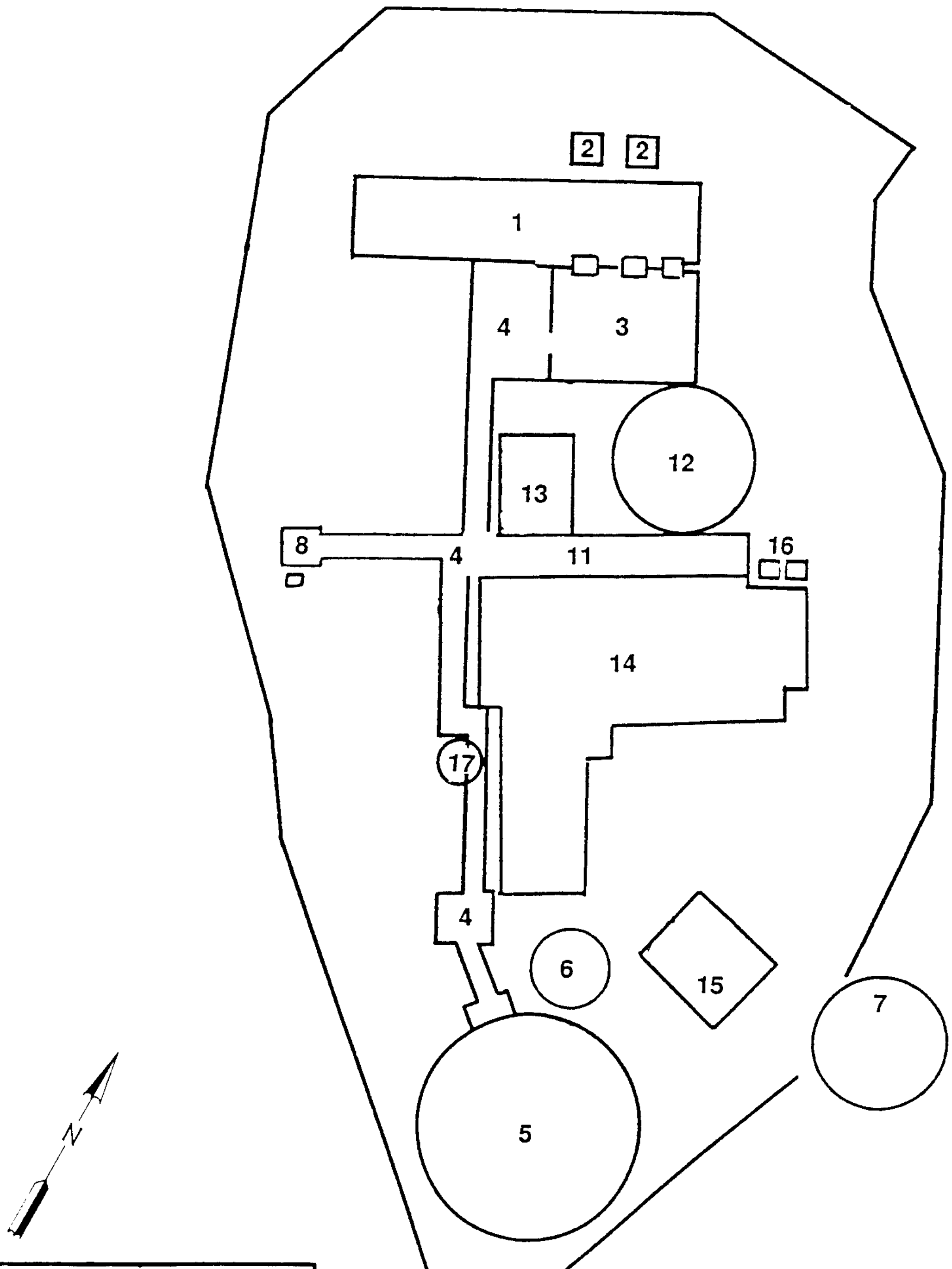
In 1982 the POL facility had a 3500-gallon fuel release caused by a pump that was left running. The POL sump was being emptied of water. The pump was not turned off when the water was removed, and the fuel was also pumped out into the City Drain.

The canal that goes through the Base starts at Sugar House, Utah, located 8 miles southeast of the Base. Residential, industrial, and airport operations,

HMTC Source: Utah ANG: Undated.

Figure 7B.

Base Map, 299 CF, Utah Air National Guard, Francis Peak Radar Station, Francis Peak, Utah



Legend

1—5 ANG BLDGS
6—8 ANG/FAA BLDGS
11—17 FAA BLDGS
Not to Scale

including chemical plants, iron work plants, and water storage areas are found along the canal before it reaches the Base.

The Base water supply is provided by the Salt Lake City Water Department. The waste water is also handled by the department.

There are no radioactive disposal areas at the Base.

Since 1978 the Base has conducted fire training exercises at a jointly-used FTA located on airport property. The Base normally uses this facility once per year.

RADAR STATION:

The Radar Station uses small amounts of diesel fuel, oil, Stoddard solvent, paints, thinners, deicing fluid, denatured alcohol, and trichloroethane. These products are used up in process or very small amounts are poured on the ground. Waste oil from the all terrain vehicles (ATVs) is taken to the Base for disposal.

There are no landfills or burials at the Radar Station.

There are no radioactive disposal areas at the Station.

Sanitary waste is disposed of in a sewer holding tank.

The Radar Station does not have USTs.

The Radar Station's water supply is provided by the Base. Water is transported from the Base to the Station by truck.

V. CONCLUSIONS

BASE:

Information obtained through interviews with 17 past and present Base personnel, a review of Base records, and field observations has resulted in the identification of seven areas that are potentially contaminated disposal and/or spill sites on Base property. These sites consist of the following:

Site No. 1 - Pesticide Dump (HAS-56)

Site No. 2 - Waste POL Spill near Building 1527 (HAS-66)

Site No. 3 - Drum Burial (HAS-56)

Site No. 4 - Fire Training Area (FTA) 1 (HAS-69)

Site No. 5 - Fire Training Area (FTA) 2 (HAS-63)

Site No. 6 - Ramp Washdown (HAS-69)

Site No. 7 - Oil Sludge Pond (HAS-69)

These sites are potentially contaminated with HM/HW, and each exhibits the potential for contaminant migration to groundwater and surface water. Therefore, these sites were assigned a HAS according to HARM.

RADAR STATION:

No sites were identified at the Radar Station.

VI. RECOMMENDATIONS

BASE:

Further IRP investigations are recommended for each of the identified sites listed below:

Site No. 1 - Pesticide Dump (HAS-56)

Site No. 2 - Waste POL Spill near Building 1527 (HAS-66)

Site No. 3 - Drum Burial (HAS-56)

Site No. 4 - Fire Training Area (FTA) 1 (HAS-69)

Site No. 5 - Fire Training Area (FTA) 2 (HAS-63)

Site No. 6 - Ramp Washdown (HAS-69)

Site No. 7 - Oil Sludge Pond (HAS-69)

RADAR STATION:

No further IRP investigation is recommended.

GLOSSARY OF TERMS

ALLUVIAL FAN - A low, outspread, relatively flat to gently sloping mass of loose rock material, shaped like an open fan, deposited by a stream (especially in a semiarid region) at the place where it issues from a narrow mountain valley upon a plain.

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of a stream or on its flood plain or delta, or as a cone or fan at the base of a mountain; especially such a deposit of fine-grained texture (silt or silty clay) deposited during the time of flood.

AMERICAN BALD EAGLE - (Haliaeetus leucocephalus) - A very large diurnal bird of prey, dark brown with a white head, neck and tail, the national emblem of the United States.

AMERICAN PEREGRINE FALCON - Any of genus (Falco) of diurnal birds of prey noted for their powerful wings, keen vision, and swiftness of attack upon their quarry; generally blackish blue above and white or grey below, formerly much used in falconry.

AMPHIBOLITE - A crystalloblastic rock consisting mainly of amphibole and plagioclase with little or no quartz. As the content of quartz increases, the rock grades into hornblende plagioclase gneiss.

ANGULAR - Having sharp angles or borders, specifically said of a sedimentary particle showing very little or no evidence of abrasion.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

AQUIFER - A geologic unit or group of formations that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

ARGILLITE - A compact rock, derived either from mudstone or shale that has undergone a somewhat higher degree of induration than mudstone or shale, but is less clearly laminated than shale, and without its fissility and lacks the cleavage distinctive of slate.

ARID [climate] - Parched with heat; dry.

ARKOSE - A feldspar rich sandstone, typically coarse-grained and pink or reddish, that is composed of angular to subangular grains that may be either poorly or moderately well sorted, is usually derived from the rapid disintegration of granite or granitic rocks, and often closely resembles granite.

ARTESIAN BASIN - A terrain, often but not necessarily basin-shaped, including an artesian aquifer whose potentiometric surface typically is above the land surface in the topographically lower portion of the terrain.

ARTESIAN WELL - A well deriving its water from a confined aquifer in which the water level stands above the ground surface; synonymous with flowing artesian well.

AXIS [geomorph] - A line that follows the trend of large landforms.

BASAL [adj] - Pertaining to, situated at, or forming the base; bottom.

BASIN - (a) A depressed area with no surface outlet; (b) A drainage basin or river basin; (c) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated.

BED [stratig] - The smallest formal unit in the hierarchy of lithostratigraphic units. In a stratified sequence of rocks, it is distinguishable from layers above and below. A bed commonly ranges in thickness from a centimeter to a few meters.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

BLOCK FAULTING - A type of normal faulting in which the crust is divided into structural or fault blocks of different elevations and orientations.

BOULDER - A detached rock mass larger than a cobble, having a diameter greater than 256 mm, being somewhat rounded or otherwise distinctly shaped by abrasion in the course of transport.

CALCAREOUS - Said of a substance that contains calcium carbonate.

CAMBRIAN - The earliest period of the Paleozoic Era, it spanned the time from approximately 570 to 500 million years ago.

CANAL [streams] - An artificial water course of relatively uniform dimensions, cut through an inland area, and designed for navigation, drainage, or irrigation by connecting two or more bodies of water.

CANYON - A long, deep, relatively narrow, steep-sided valley confined between lofty and precipitous walls in a plateau or mountainous area.

CENOZOIC - An era of geologic time from the beginning of the Tertiary Period (about 65 million years ago) to the present.

CHANNEL - The bed where a natural body of surface water flows or may flow; a natural passageway or depression of perceptible extent containing continuously or periodically flowing water, or forming a connecting link between two bodies of water; a watercourse.

CHERT - A hard, extremely dense or compact, microcrystalline siliceous rock.

CLAY [soil] - A rock or mineral particle in the soil having a diameter less than 0.002 mm (2 microns).

CLAY [geol] - A rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 1/256 mm (4 microns).

COARSE-GRAINED - Said of a soil or sediment in which gravel and/or sand predominates.

COBBLE [part size] - A rock fragment larger than a pebble and smaller than a boulder, having a diameter in the range of 64-256 mm (2.5 - 10 in) being somewhat rounded.

CONFINED GROUNDWATER - Groundwater under pressure beneath relatively impermeable rocks or sediment.

CONGLOMERATE - A coarse-grained clastic sedimentary rock, composed of rounded to subgranular fragments larger than 2 mm in diameter set in a fine matrix of sand or silt, and commonly cemented by calcium carbonate, iron oxide, silica or hardened clay.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but not be limited to any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substances Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CONTINENTAL [climate] - The climate of the interior of a continent, characterized by seasonal temperature extremes and by the occurrence of a maximum and minimum temperature soon after summer and winter solstice, respectively.

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CREST [geomorph] - The highest point or line of a landform from which the surface slopes downward in opposite directions.

CRETACEOUS - The final period of the Mesozoic Era (after the Jurassic and before the Tertiary Period of the Cenozoic Era); it covered the time span between approximately 135 and 65 million years ago.

CRITICAL HABITAT - The specific areas within the geographical area occupied by the species on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection.

CROSS-BEDDING - Cross-stratification in which cross-beds are more than 1 cm in thickness.

DEFORMATION - A general term for the process of folding, faulting, shearing, compression, or extension of the rocks as a result of various Earth forces.

DELTA - The low, nearly flat, alluvial tract of land at or near the mouth of a river, commonly forming a triangular or fan-shaped plain of considerable area.

DEPOSIT - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

DEPOSITION - (a) The laying, placing, or throwing down of any material (b) material that is deposited; a deposit or sediment.

DEVONIAN - A period of the Paleozoic era (after the Silurian and before the Mississippian); it covered the time span from 400 to 345 million years ago.

DIABASE - An intrusive rock whose main components are labradorite and pyroxene and which is characterized by ophitic texture.

DIKE - A tabular igneous intrusive that cuts across the bedding or foliation of the country rock.

DOLOMITE [rock] - A carbonate sedimentary rock of which more than 50% by weight or by areal percentages under the microscope consists of the mineral dolomite, or a variety of limestone or marble rich in magnesium carbonate.

DOWNGRADIENT - A direction that is hydraulically downslope.

DRAIN - A small, narrow, natural watercourse.

DRAINAGE CLASS [natural] - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or peridocially receive high rainfall, or both.

Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough periods during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

EROSION - The general process or the group of processes whereby the materials of the Earth's crust are loosened, dissolved, or worn away, and simultaneously moved from one place to another by natural agencies, but usually exclude mass wasting.

ESTUARY - The seaward end or widened funnel-shaped tidal mouth of a river valley where fresh water comes in contact with seawater and where tidal effects are evident.

ETHYLENE GLYCOL - A colorless, sweetish alcohol $C_2H_4(OH)_2$ formed by decomposing certain ethylene compounds and used as an antifreeze mixture, lubricant, etc.

EVAPOTRANSPIRATION - Loss of water from a land area through transpiration of plants and evaporation.

FAULT [struc geol] - A fracture or a zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture.

FAULT ZONE - A fault that is expressed as a zone of numerous small fractures or of breccia or fault gorge.

FELDSPAR - A group of abundant rock-forming minerals of general formula:

> $MAl(Al,Si)_3O_8$, where M = K, Na, Ca, Ba, Rb, Sr, and Fe. Feldspars are the most widespread of any mineral group and constitute 60% of the Earth's crust; they occur as components of all kinds of rocks (crystalline schists, migmatites, gneisses, granites, most magmatic rocks) and as fissure minerals in clefts and druse minerals in cavities.

FINE-GRAINED - Said of a soil or sediment in which silt and/or clay predominate.

FLOOD PLAIN - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

FOLD [geol struc] - A curve or bend of a planar structure such as rock strata, bedding planes, foliation or cleavage.

FORMATION - A lithologically distinctive, mappable body of rock.

FOSSIL - Any remains, trace, or imprint of a plant or animal that has been preserved in the Earth's crust.

FOSSILIFEROUS - Containing fossils.

FRACTURE [struc geol] - A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints and faults.

FRAGMENT - (a) A rock or mineral particle larger than a grain (b) a piece of rock that has been detached or broken from a pre-existing mass.

GABBRO - A group of dark-colored, basic intrusive igneous rocks composed principally of basic plagioclase and clinopyroxene, with or without olivine and orthopyroxene; approximate intrusive equivalent of basalt.

GEOSYNCLINE - A mobile downwarping of the crust of the Earth, either elongated or basin like, measured in scores of kilometers, in which sedimentary and volcanic rocks accumulate to a thickness of thousands of meters.

GLACIAL - (a) Of or relating to the presence and activities of ice or glaciers, (b) Pertaining to distinctive features and materials produced or derived from glaciers and ice sheets.

GNEISS - A foliated rock formed by regional metamorphism, in which bands or lenticles of granular minerals alternate with bands or lenticles in which minerals having flaky or elongated prismatic habits predominate.

GNEISSIC - Pertaining to the texture or structure typical of gneiss.

GRANITE - Broadly applied, any crystalline, quartz-bearing plutonic rock; also commonly contains feldspar, mica, hornblende, or pyroxene.

GRANITIC - Pertaining to the texture or structure typical of granite.

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GRAVELLY LOAM - A loam that contains an abundance of gravel, usually between 35% and 60% by volume.

GRAVELLY SILT LOAM - A silt loam that contains an abundance of gravel, usually between 35% and 60% by volume.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health and welfare and environmental impacts.

HAS - Hazard Assessment Score - The score developed by using the Hazardous Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

a) cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or

b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HERBICIDE - A weed killer.

IGNEOUS ROCK - Rock or mineral that has solidified from molten or partially molten material, i.e. from a magma.

INTERBEDDED - Beds lying between or alternating with others of different character; especially rock material laid down in sequence between other beds.

INTERTWINED - To twine together; intertwist; to twist together.

JOINT [struc geol] - A surface of a fracture or parting in a rock, without displacement.

JURASSIC - The second period of the Mesozoic Era (after the Triassic and before the Cretaceous); it covered the span of time between approximately 190 and 135 million years ago.

KETONE - One of a class of organic compounds in which the carbonyl radical unites with two hydrocarbon radicals, i.e., acetone, methyl ethyl ketone.

LAGOON - Body of shallow water, particularly one possessing a restricted connection with the sea; water body within an atoll or behind barrier reefs or islands.

LAKE PLAIN - The nearly level surface marking the floor of an extinct lake, filled in by well-sorted deposits from inflowing streams.

LIMESTONE - A sedimentary rock consisting primarily of calcium carbonate, primarily in the form of the mineral calcite.

LIMY - Pertaining to or consisting of limestone or lime.

LITHIFY - To change to stone, or to petrify; especially to consolidate from a loose sediment to a solid rock.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles and usually containing organic matter.

MASSIVE [meta] - Said of a metamorphic rock whose constituents are neither orientated in a parallel position nor arranged in layers.

MATRIX [sed] - The finer-grained material enclosing, or filling the interstices between, the larger grains or particles of a sediment of sedimentary rock.

MEAN LAKE EVAPORATION - The total evaporation amount for a particular area; amount based on precipitation and climate (humidity).

MEDIAL - Middle.

MESOZOIC - An era of geologic time from the end of the Paleozoic to the beginning of the Cenozoic or from about 225 to about 65 million years ago.

METAMORPHIC ROCK - Any rock derived from pre-existing rocks by minerological, chemical, and/or structural changes, essentially in solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the Earth's crust.

MISSISSIPPIAN - A period of the Paleozoic Era (after the Devonian and before the Pennsylvanian); it spans the time from 345 to 200 million years ago.

MOTTLED [soil] - A soil that is irregularly marked with spots or patches of different colors, usually indicating poor aeration or seasonal wetness.

MOUNTAIN - Any part of the Earth's crust higher than a hill, sufficiently elevated above the surrounding land surface of which it forms a part to be worthy of a distinctive name, characterized by a restricted summit area, usually 300 m (1000 ft) above the surrounding land.

MUD [sed] - A mixture of water and silt- or clay-sized earth material.

MUD CRACK - An irregular fracture in a crudely polygonal pattern, formed by the shrinkage of clay, silt, or mud; generally in the coarse of drying under the influence of atmospheric surface conditions.

MUD FLAT - A relatively level area of fine silt along a shore or around an island, alternatively covered and uncovered by the tide, or covered by shallow water.

MUDSTONE - An indurated mud having the texture and composition of shale but lacking its fine lamination or fissility.

NET PRECIPITATION - Precipitation minus evaporation.

OOZE [sed] - A soft, soupy mud or slime, typically found covering the bottom of a river, estuary, or lake.

OUTCROP - That part of a geologic formation or structure that appears at the surface of the Earth; also, bedrock that is covered only by surficial deposits such as alluvium.

PALEOZOIC - An era of geologic time from the end of the Precambrian to the beginning of the Mesozoic or from 570 to about 225 million years ago.

PD-680 - A cleaning solvent composed predominately of mineral spirits; Stoddard solvent.

PEBBLE - A general term for a small, roundish stone; a rock fragment larger than a granule and smaller than a cobble; having the diameter in range of 4-64 mm (1/6 to 2.5 in).

PEGMATITE - An exceptionally coarse-grained igneous rock with interlocking crystals, usually found as irregular dikes, lenses, or veins, especially at the margins of batholiths.

PERCHED WATER - Unconfined groundwater separated from an underlying main body of groundwater by an unsaturated zone.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

PERMIAN - The last period of the Paleozoic Era (after the Pennsylvanian); it spanned the time between approximately 280 and 225 million years ago.

PESTICIDE - A chemical or other substance used to destroy plant and animal pests.

PHYLLITE [petrology] - A metamorphosed rock, intermediate in grade between slate and mica schist.

PHYSIOGRAPHIC PROVINCE - Region of similar structure and climate that has had a unified geomorphic history.

PIEZOMETRIC CONTOUR (Equipotential Line) - A contour line along which the pressure head of groundwater in an aquifer is the same.

PLAIN - Any flat area, large or small, at a low elevation, specifically an extensive region of comparatively smooth and level or gently undulating land, having few or no prominent surface irregularities but sometimes having a considerable slope, and usually at a low elevation with reference to surrounding areas.

PLATFORM [geomorph] - (a) A general term for any level or nearly level surface; (b) a small plateau.

PRECAMBRIAN - All geologic time, and its corresponding rocks, before the beginning of the Paleozoic; it is equivalent to 90% of geologic time, time span of 570 million years ago and older.

QUARTZ - A Crystalline silica, an important rock forming mineral: SiO_2. Occurs either in transparent hexagonal crystals (colorless or colored by impurities) or in crystalline rock. Forms the major proportion of most sands and has a widespread distribution in igneous, metamorphic and sedimentary rocks.

QUARTZITE [meta] - A granoblastic metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by either regional or thermal metamorphism.

QUATERNARY - The second period of the Cenozoic Era, following the Tertiary: it began 3 to 2 million years ago and extends to the present.

RECRYSTALLIZATION - The formation of new mineral grains in a rock while in the solid state. The new grains are generally larger than the original grains and may have the same or a different mineralogical composition.

REGRESSION - The retreat or contraction of the sea from land areas and the consequent evidence of such withdrawal.

RESERVOIR [water] - An artificial or natural storage place for water, such as a lake or pond from which the water may be withdrawn as for irrigation, municipal water supply, or flood control.

RIPPLE MARK - One of the small and fairly regular ridges, of various shapes and cross-sections, produced on a ripple-marked surface.

ROCK - An aggregate of one or more minerals; or a body of undifferential mineral matter.

SALINE [adj] - (a) Salty; containing sodium chloride.

SAND - A rock or mineral particle in the soil, having a diameter in the range of 0.52 - 2 mm.

SANDSTONE - A medium-grained fragmented sedimentary rock composed of abundant round or angular fragments of sand, size-set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate).

SANDY CLAY LOAM - A soil containing 20 - 30% clay, 45 - 80% sand, and less than 28% silt.

SANDY LOAM - A soil containing 43 - 85% sand, 0 - 50% silt, and 0 - 20% clay, or containing at least 52% sand and no more than 20% clay and having the percentage of silt plus twice the percentage of clay exceeding 30, or containing 43 - 52% sand, less than 50% silt, and less than 7% clay.

SCHIST - A strongly foliated crystalline rock, formed by dynamic metamorphism, that can be readily split into thin flakes or slabs due to the well developed parallelism of more than 50% of the minerals present, particularly those of lamellar or elongate prismatic habit, e.g. mica and hornblende.

SEDIMENT - Soil fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

SEDIMENTARY ROCK - A rock resulting in the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

SEEP - An area, generally small, where water or soil percolates slowly to the land surface; a flow too small to be considered as a spring.

SEMIARID [climate] - Said of a type of climate in which there is slightly more precipitation (25-50 cm) than in an arid climate, and in which sparse grasses are the characteristic regeneration.

SHALE - A fine-grained detrital sedimentary rock, formed by the consolidation (especially by compression) of clay, silt, or mud.

SILICIFICATION [meta] - The introduction of or replacement by silica, generally resulting in the formation of fine-grained quartz, chalcedony, or opal, which may fill pores and replace existing minerals.

SILL - A tabular body of igneous rock that parallels the planar structure of the surrounding rock.

SILT [geol] - A rock fragment or detrital particle smaller than a very fine sand grain and larger than coarse clay, having a diameter in the range of 0.004 to 0.063 mm.

SILT [soil] - (a) A rock or mineral particle in the soil, having a diameter in the range 0.002-0.005 mm; (b) A soil containing more than 80% silt-size particles, less than 12% clay, and less than 20%.

SILTSTONE - A rock containing 50 - 88% silt, 0 - 27% clay, and 0 - 50% sand.

SILTY CLAY LOAM - A soil containing 27 - 40% clay, 60 - 73% silt, and less than 20% sand.

SLOPE - (a) Gradient; (b) The inclined surface of any part of the Earth's surface.

SOIL REACTION - The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests at pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

SOIL STRUCTURE - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are -- platty (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single-grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SOLVENT - A substance, generally a liquid, capable of dissolving other substances.

SPRING - A place where water flows naturally from a rock or the soil onto the land surface or into a body of surface water.

STONE - A general term for rock that is used for construction, either crushed for use as aggregate or cut into shaped blocks as dimension stone.

STRATIFIED - Formed, arranged, or laid down in layers or strata; especially said of any layered sedimentary rock or deposit.

STREAM - Any body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the surface of the ground; smaller than river; Syn : brook.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.
SYNCLINE - A fold of which the core contains the stratigraphically younger rocks; it is generally concave upward.

TECTONIC - Said of or pertaining to the forces involved in, or the resulting structures or features of tectonics (a branch of geology dealing with the broad architecture of the outer part of the Earth, that is, the regional assembling of structural or deformational features, a study of their mutual relations, origin, and historical elevation.

TERTIARY - The first period of the Cenozoic Era; it spans the time between approximately 65 and 3 to 2 million years ago.

THERMAL [phys] - Pertaining to or caused by heat.

THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

THRUST FAULT - A fault with a 45^{0} dip or less over much of its extent, on which the hanging wall appears to have moved upward relative to the foot wall.

TILLITE - A consolidated or indurated sedimentary rock formed by lithification of glacial till.

TILT - The angle at the perspective center between the plumbline and the perpendicular from the interior perspective center to the plane of the photograph.

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and man-made features.

TRANSGRESSION - The spread or extension of the sea over land areas and the consequent evidence of such advance.

TRIASSIC - The first period of the Mesozoic Era (after the Permian of the Paleozoic Era and before the Jurassic); it spanned the time from 225 to 190 million years ago.

TRIBUTARY - A stream feeding, joining, or flowing into a larger stream or into a lake.

TROUGH [geomorph] - Any long, narrow depression in the Earth's surface, such as one between hills or with no surface outlet for drainage.

TUFF - A general term for all consolidated pyroclastic rocks.

TUFFACEOUS - Said of sediments containing up to 50% tuff.

UNCONFORMITY - A substantial break or gap in the geologic record where a rock unit is overlain by another that is not next in stratigraphic succession, such as an interruption in the continuity of a depositional sequence of sedimentary rocks or a break between eroded igneous rocks and younger sedimentary strata.

UNCONSOLIDATED MATERIAL - A sediment that is loosely arranged or whose particles are not cemented together, occurring either at the surface or at depth.

UPLIFT [tect] - A structurally high area in the crust, produced by positive movements that raise or upthrust the rocks, as in a dome or arch.

UPWARPING - The uplift of a regional area of the Earth's crust, usually as a result of the release of isostatic pressure.

VALLEY - Any low-lying land bordered by higher ground, especially an elongate, relatively large, gently sloping depression of the Earth's surface, commonly situated between two mountains or between ranges of hills and mountains, and often containing a stream or river with an outlet. It is usually developed by stream or river erosion, but can be formed by faulting.

WATER-LAID - Deposited in or by water.

WATER TABLE - The upper limit of the portion of the ground that is wholly saturated with water.

WATERWAY - A way or channel, either natural or artificial, for conducting the flow of water.

WETLANDS - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

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United States Department of Defense. Defense Environmental Quality Program Policy Memorandum (DEQPPM 81-5), December 11, 1981.

United States Fish and Wildlife Service. National Wetlands Inventory Map (Salt Lake City North, Utah), U.S. Department of the Interior, June 1981.

United States Geological Survey. Peterson, Utah Quadrangle. 7.5 Minute Series (Topographic), Photorevised 1969 and 1975.

United States Geological Survey. Salt Lake City North, Utah Quadrangle. 7.5 Minute Series (Topographic), Photorevised 1967 and 1975.

United States Geological Survey. Farmington Canyon Complex and Surrounding Rocks in the Wasatch Mountains Between Ogden and Bountiful, Utah. Miscellaneous Investigations Series, no date.

Utah Air National Guard. Map of Francis Peak Radar Station. 299th Communications Flight (Range Support), no date.

Appendix A

Resumes of Search Team Members

NATASHA M. BROCK

EDUCATION

Graduate work, civil/environmental engineering, University of Maryland, 1987-present
Graduate work, civil/environmental engineering, University of Delaware, 1985-1986
B.S. (cum laude), environmental science, University of the District of Columbia, 1984
Undergraduate work, biology, The American University, 1978-1980

CERTIFICATION

Health & Safety Training Level C

EXPERIENCE

Three years' experience in the environmental and hazardous waste field. Work performed includes remedial investigations/feasibility studies, RCRA facility assessments, comprehensive monitoring evaluations, and remedial facility investigations. Helped develop and test biological and chemical processes used in minimization of hazardous and sanitary waste generation. Researched multiple substrate degradation using aerobic and anaerobic organisms.

EMPLOYMENT

Dynamac Corporation (1987-present): Environmental Scientist

In working for Dynamac's Hazardous Materials Technical Center (HMTC), performs Preliminary Assessments, Remedial Investigations and Feasibility Studies (PA/RI/FS) under the Air National Guard Installation Restoration Program. Specifically involved in determining rates and extent of contamination, recommending groundwater monitoring procedures, and soil sampling and analysis procedures. In the process of preparing standard operating procedure manuals for quick remedial response to site spills and releases, and PA/RI/FS.

C.C. Johnson & Malhotra, P.C. (1986-1987): Environmental Scientist

Involved as part of a team in performing Remedial Investigations/Feasibility Studies (RI/FS) for EPA Regions I and IV under Resource Conservation and Recovery Act (RCRA) work assignments for REM II projects. Participated on a team involved in RCRA Facility Assessments (RFAs), Comprehensive Monitoring Evaluations (CMEs), and Remedial Facility Investigations (RFIs) for EPA work assignments under RCRA for REM III projects in Regions I and IV. Work included solo oversight observations of field sampling and facility inspections. Additional responsibilities included promotion work, graphic layout, data entry-quality check for various projects. Certified Health & Safety Training Level C.

Work Force Temporary Services (1985-1986): Research Scientist

In working for DuPont's Engineering Test Center, helped in the development and testing of laboratory-scale biological and chemical processes for a division whose main purpose was to reduce the amount of hazardous waste generated. Also worked for Hercules, Inc., with a group involved in polymer use for wastewater treatment for clients in various industrial fields. Specifically involved in product consultation, troubleshooting, and product development.

National Oceanic and Atmospheric Administration (1982-1984): Research Assistant

Involved with an information gathering and distribution center of weather impacts worldwide. Specifically involved in data collection, distribution of data to clients, assessment production and special reports.

BETSY A. BRIGGS

EDUCATION

B.S., Biology and Chemistry, State University College of New York at Cortland, 1979

Completed several courses in M.B.A. program, University of Phoenix, Denver, Colorado Division, 1984

SPECIALIZED TRAINING

Hazardous Waste Management course, Air Force Institute of Technology, 1986

CERTIFICATION

Certified Hazardous Materials Manager, Institute of Hazardous Materials Management, 1985

SECURITY CLEARANCE

Secret/DOE

EXPERIENCE

Nine years of experience including three years in hazardous waste management, two years as an environmental engineer, two years as an ecologist, and two years in laboratory research. Has conducted ambient air quality monitoring programs, critical pathways projects to study movement of radioactive materials in the environment, metallurgic laboratory analyses, and independent studies in biology and chemistry. Currently provides managerial oversight and technical support to a hazardous waste program for the Air Force.

EMPLOYMENT

Dynamac Corporation (1985-present): Program Manager/Hazardous Waste Specialist

Primary responsibility as program manager is to oversee and manage up to 44 field personnel involved in RCRA and CERCLA work in support of the U.S. Air Force. Other duties include performing preliminary assessments/site surveys for the Air National Guard, marketing and proposal preparation, and preparing and providing training in preparation for the Certified Hazardous Materials Manager examination.

As hazardous waste specialist the primary responsibility was to manage the hazardous waste program at Myrtle Beach Air Force Base. Duties included:

- o Reviewing the design and specifications of various base construction projects and overseeing such projects to ensure compliance with all applicable state and federal hazardous waste regulations. Projects under design included a corrosion control facility, TSD facility, two accumulation points, and a parts cleaning vat system. Construction project oversight included the final inspection of the entomology building to ensure that the facility was equipped for proper storage, usage and disposal of pesticides; removal of materials contaminated with pesticides, PCBs, petroleum products, and solvents from six sites; asbestos removal and disposal from a former hangar site; and the removal of two underground storage tanks, one of which was leaking.
- o Conducting surveys of hazardous waste generating activities.
- o Advising on need for and methods of minimizing hazardous waste generation.
- o Writing and maintaining hazardous waste management plan.
- o Preparing hazardous waste management reports and documents required by state and federal law.
- o Maintaining liaison with federal and state regulatory agencies on matters involving criteria, standards, performance specifications, and monitoring.
- o Providing information and technical consultation to Air Force installation staff regarding hazardous materials and hazardous waste operations.
- o Serving as ad hoc advisor to environmental contingency response teams.

<u>Rockwell International (1982-1984)</u>: Environmental Engineer

Primary responsibility was collection, evaluation, and reporting of ambient air monitoring data. Other responsibilities included technical assistance for monitoring total suspended solids in ambient air. Also performed data collection and reduction of air effluent emission control activities.

Environmental monitoring and control programs are to ensure that all Department of Energy and other governmental effluent regulations are met, and that plant effluents are consistent with the As Low As Reasonably Achievable (ALARA) Principle. Monthly and Annual Reports summarize the effluent and environmental monitoring programs.

<u>Rockwell International (1980-1982)</u>: Ecologist

Responsible for planning, organizing, and leading critical pathways projects designed to study the movement of radioactive materials throughout the environment. Projects were: (1) general critical pathway evaluation to identify

sampling points possibly not considered in present monitoring program; (2) plant uptake versus plant uptake plus foliar deposition measurement study; (3) deer tissue analysis program; and (4) food stuff monitoring program. Progress and results were published in semiannual reports.

Colorado School of Mines Research Institute, Texas Gulf Research Laboratory (1979-1980): Senior Laboratory Technician

Work involved quantitative analysis of platinum, palladium, and silver in soil samples. Analysis included sample preparation, fire assays, calorimetric procedures, and smelt tests.

State University College of New York at Cortland (1978-1979): Undergraduate Independent Study

Project involved the isolation of trail pheromone from spun silk of *Hyphantria* (fall webworm). Included organic and inorganic extraction procedures and performing bioassays. Also worked on production of synthetic diet comparable to fresh leaf diet for *Malacosomo* (eastern tent caterpillar).

PUBLICATIONS

Hazardous Waste Management Survey for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1986 and 1988.

Hazardous Waste Management Plan for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1987 and 1988.

Waste Minimization Guidance for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1988.

Underground Storage Tank Management Plan for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1988.

Annual Environmental Monitoring Report, Rockwell International, Energy Systems Group, Rocky Flats Plant, 1982 and 1983.

Environmental Studies Group Semiannual Report, Rockwell International, Energy Systems Group, Rocky Flats Plant, June/December of 1980 and 1981.

TECHNICAL PRESENTATIONS

PCB Management, Myrtle Beach Air Force Base, 1987.

Underground Storage Tank Regulations/History, Myrtle Beach Air Force Base, 1986.

Overview of the Hazardous Waste Training Program, Myrtle Beach Air Force Base, 1985.

Overview of the Environmental Studies Group, Nevada Test Site and Rockwell International at Hanford, Washington, 1981.

RAYMOND G. CLARK, JR.

EDUCATION

Completed graduate engineering courses, George Washington University, 1957
B.S., Mechanical Engineering, University of Maryland, 1949

SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969
Grad. Army Psychological Warfare School, Fort Bragg, 1963
Grad. Sanz School of Languages, D.C., 1963
Grad. DOD Military Assistance Institute, Arlington, 1963
Grad. Defense Procurement Management Course, Fort Lee, 1960
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303); Florida (#36228)

EXPERIENCE

Thirty-one years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

EMPLOYMENT

Dynamac Corporation (1986-present): Program Manager/Department Manager

Responsible for activities relating to Preliminary Analysis, Site Investigations, Remedial Investigations, Feasibility Studies, and Remedial Action for the Installation Restoration Program for the U.S. Air Force, Air National Guard, Bureau of Prisons, and the U.S. Coast Guard, including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; preparation of Air Force Installation Restoration Program Management Guidance; and preparation of Part B permits.

Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of $163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of $15 million; design and construction of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost $250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested

in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than $256 million. Planned and developed the first five-year master plan for this area. Administered $12 million budget and $2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth $9 million for essential maintenance and repair. Directed cost reduction programs that produced more than $500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than $75

million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than $200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over $21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately $159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

PROFESSIONAL AFFILIATIONS

Member, National Society of Professional Engineers
Fellow, Society of American Military Engineers
Member, American Society of Civil Engineers
Member, Virginia Engineering Society
Member, Project Management Institute

HARDWARE

IBM PC

SOFTWARE

Lotus 1-2-3, D Base III Plus, Framework, Project Scheduler 5000, Harvard Project Manager, Volkswriter, Microsoft Project

MARK D. JOHNSON

EDUCATION

B.S., Geology, James Madison University, 1980

EXPERIENCE

Eight years' technical and management experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance, preparation of statements of work for environmental field monitoring and feasibility studies for the Air Force and the Air National Guard, development of environmental field monitoring programs, and preparation of Preliminary Assessments for the Air National Guard.

EMPLOYMENT

Dynamac Corporation (1984-present): Senior Staff Scientist/Geologist

Primarily responsible for developing and managing technical support programs relevant to CERCLA related activities for the Air Force, Air National Guard, Department of Justice and Coast Guard. These activities include Statements of Work for Site Investigations (SI), Remedial Investigations (RI), and Feasibility Studies (FS); assessing groundwater at hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for developing SI and RI programs and identifying remedial actions; reviewing SI, RI and FS contractor work plans for various government clients, developing technical and contractual requirements for SI, RI and FS projects, managing the development and preparation of Preliminary Assessments, and assisting clients in the development of their environmental management programs, which included preparation of the Air Force's Installation Restoration Program Management Guidance document.

Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

PROFESSIONAL CREDENTIALS

Registered Professional Geologist, South Carolina, #116, 1987

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists
National Water Well Association/Association of Ground Water Scientists and Engineers

JANET SALYER EMRY

EDUCATION

M.S., Geology, Old Dominion University, 1987
B.S. (cum laude), Geology, James Madison University, 1983

EXPERIENCE

Three years of technical experience in the fields of hydrogeology and environmental science, including drilling and placement of wells, well monitoring, aquifer testing, determination of hydraulic properties, computer modeling of aquifer systems, and field and laboratory soils analysis. Experienced in addressing technical and public audiences concerning hazardous waste site risks and proposed remedial actions.

EMPLOYMENT

Dynamac Corporation (1987-present): Staff Scientist/Hydrogeologist

Responsibilities include technical and public forum support for Preliminary Assessments, Site Investigations, Remedial Investigations, Feasibility Studies, and Emergency Responses to include providing geological and hydrological assessments of hazardous waste disposal/spill sites, determination of rates and extents of contaminant migration, and computer modeling of groundwater flow and contaminant transport. Assists site personnel in the communication of risk evaluations to the surrounding community.

Froehling and Robertson, Inc. (1986-1987): Geologist/Engineering Technician

Performed both field and laboratory engineering soils tests.

The Nature Conservancy (1985-1986): Hydrogeologist

Investigated groundwater geology of the Nature Conservancy's Nags Head Woods Ecological Preserve in Dare County, North Carolina. Study included installing wells, monitoring water table levels, determination of hydraulic parameters through a pumping test, stratigraphic test borings, and computer modeling.

Old Dominion University (1983-1985): Teaching Assistant, Department of Geological Sciences

Taught laboratory classes in Earth Science and Historical Geology.

PROFESSIONAL AFFILIATIONS

Geological Society of America
National Water Well Association/Association of Ground Water Scientists and Engineers

PUBLICATION

Impact of Municipal Pumpage Upon a Barrier Island Water Table, Nags Head and Kill Devil Hills, North Carolina. In: Abstracts with Programs, Geological Society of America, Vol. 19, No. 2, February 1987.

Appendix B

Outside Agency

Contact List

OUTSIDE AGENCY CONTACT LIST

1. Department of Natural Resources
   Division of Water Rights
   1636 West N. Temple
   Salt Lake City, UT 84116
   (801) 538-7431

2. United States Fish and Wildlife Service
   Utah State Office
   2078 Administration Building
   1745 West 1700 South
   Salt Lake City, UT 84104
   (801) 524-5630

3. National Oceanic and Atmospheric Administration
   6010 Executive Blvd.
   Rockville, MD 20852
   (301) 443-8910

4. Salt Lake City Public Utilities
   1530 South Jefferson Street
   Salt Lake City, UT 84115
   (801) 483-6772

5. U.S. Geological Survey
   12201 Sunrise Valley Drive
   Reston, VA 22092
   Library
   (703) 648-4000

Appendix C

USAF Hazard Assessment Rating Methodology

USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has developed a comprehensive program to identify, evaluate, and control hazardous waste disposal practices associated with past waste disposal techniques at DoD facilities. One of the actions required under this program is to:

> Develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, December 11, 1981).

Accordingly, the U.S. Air Force has sought to establish a system to set priorities for taking further action at sites based upon information gathered during the Preliminary Assessment phase of the Installation Restoration Program.

PURPOSE

The purpose of the site rating model is to assign a ranking to each site where there is suspected contamination from hazardous substances. This model will assist the National Guard in setting priorities for follow-up site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous waste present in sufficient quantity), and (2) potential for migration exists. A site may be deleted from ranking consideration on either basis.

DESCRIPTION OF THE MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score

based on the most likely routes of contamination and worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors presented in this appendix. The site rating form and the rating factor guidelines are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: (1) possible receptors of the contamination, (2) the waste and its characteristics, (3) the potential pathways for contaminant migration, and (4) any effort that was made to contain the waste resulting from a spill.

The receptors category rating is based on four rating factors: (1) the potential for human exposure to the site, (2) the potential for human ingestion of contaminants should underlying aquifers be polluted, (3) the current and anticipated use of the surrounding area, and (4) the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1000 feet of the site and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore is computed as follows: receptors subscore = (100 X factor subtotal/maximum score subtotal).

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence

in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score while scores for solids are reduced.

The pathways category rating is based on evidence of contaminant migration along one of three pathways: surface water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated, and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. The waste management practice category is then scored. Scores for sites with no containment are not reduced. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well-managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the score for the other three categories.

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE

LOCATION ______

DATE OF OPERATION OR OCCURRENCE ______

OWNER/OPERATOR ______

COMMENTS/DESCRIPTION ______

SITE RATED BY ______

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site		4		12
B. Distance to nearest well		10		30
C. Land use-zoning within 1 mile radius		3		9
D. Distance to installation boundary		6		18
E. Critical environments within 1 mile radius of site		10		30
F. Water quality of nearest surface water body		6		18
G. Groundwater use of uppermost aquifer		9		27
H. Population served by surface water supply within 3 miles downstream of site		6		18
I. Population served by groundwater supply within 3 miles of site		6		18
		Subtotals	______	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal)

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix)

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
______ x ______ = ______

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

______ x ______ =

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24
Subtotals				108

Subscore (100 x factor score subtotal/maximum score subtotal)

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24
Subtotals				114

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors
Waste Characteristics
Pathways

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

______ x ______ = ______

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

	Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A.	Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B.	Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C.	Land use/zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D.	Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E.	Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands	10
F.	Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G.	Groundwater use of uppermost aquifer	Not used, other sources readily available	Commercial Industrial, or Irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available, commercial, industrial, or irrigation; no other water source available	9
H.	Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	Greater than 1,000	6
I.	Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability, and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	H
	H	C	H
70	L	S	H
60	S	C	H
	H	C	H
50	L	S	H
	L	C	L
	H	S	H
	S	C	H
40	S	S	H
	H	S	H
	H	C	L
	L	S	L
30	S	C	L
	H	S	L
	S	S	H
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level
- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating
- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., HCM + SCH = LCH if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an HCM designation (60 points). By adding the quantities of each waste, the designation may change to LCH (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical state	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, groundwater, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reporte discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 Potential for Surface Water Contamination

Rating Factors	0	1	2	3	Multiplie
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to a mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($>10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year, 24 hour rainfall (thunderstorms)	<1.0 inch 0-5 0	1.0 to 2.0 inches 6-35 30	2.1 to 3.0 inches 36-49 60	>3.0 inches >50 100	8

B-2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplie
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Groundwater Contamination

Rating Factors	0	1	2	3	Multiplie
Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay 10^{-2} to 10^{-4} cm/sec	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high groundwater level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean groundwater level	8
Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-B-3, then leave blank for calculation of factor score and maximum possible score.

Appendix D

Site Hazardous Assessment Rating Forms and Factor Rating Criteria

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 1 - Pesticide Dump

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE Prior to 1977

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
40 x 1.0 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
40 x 1.0 = 40

III. PATHWAYS Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
		Subtotals	64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
		Subtotals	68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	40
Pathways	60

Total 168 divided by 3 = 56
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

56 x 1.0 = 56

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 2 - Waste POL Spill Near Building 1527

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE 1987

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
60 x 1.0 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
Subtotals			68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	60
Pathways	80

Total 208 divided by 3 = 69
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

69 x 0.95 = 66

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 3 - Drum Burial

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE Prior to 1977

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) S

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
40 x 1.0 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
40 x 1.0 = 40

III. PATHWAYS Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
Subtotals			68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	40
Pathways	60

Total 168 divided by 3 = 56
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

56 x 1.0 = 56

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 4 - FTA 1

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE 1947 to 1972

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
80 x 1.0 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
		Subtotals	64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
		Subtotals	68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	80
Pathways	60

Total 208 divided by 3 = 69
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

69 x 1.0 = 69

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 5 - FTA 2

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE 1973 to 1975

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
60 x 1.0 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
Subtotals			68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	60
Pathways	60

Total 188 divided by 3 = 63
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

63 x 1.0 = 63

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 6 - Ramp Washdown

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE 1950s to 1960s

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
80 x 1.0 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
Subtotals			68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	80
Pathways	60

Total 208 divided by 3 = 69
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

69 x 1.0 = 69

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 7 - Oil Sludge Pond

LOCATION Utah Air National Guard, Salt Lake City, Utah

DATE OF OPERATION OR OCCURRENCE Mid 1950s to 1972

OWNER/OPERATOR 151st Air Refueling Group

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use-zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 68

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
80 x 1.0 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to groundwater	0	8	0	24
Subtotals			68	114

Subscore (100 x factor score subtotal/maximum score subtotal) 60

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 60

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	68
Waste Characteristics	80
Pathways	60

Total 208 divided by 3 = 69
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

69 x 1.0 = 69

151st Air Refueling Group
Utah Air National Guard
Salt Lake City International Airport
Salt Lake City, Utah

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

1. RECEPTORS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Population within 1,000 feet of site:		
Site No. 1	Greater than 100	3
Site No. 2	Greater than 100	3
Site No. 3	Greater than 100	3
Site No. 4	Greater than 100	3
Site No. 5	Greater than 100	3
Site No. 6	Greater than 100	3
Site No. 7	Greater than 100	3
Distance to nearest well:		
Site No. 1	Below 3,000 feet	3
Site No. 2	Below 3,000 feet	3
Site No. 3	Below 3,000 feet	3
Site No. 4	Below 3,000 feet	3
Site No. 5	Below 3,000 feet	3
Site No. 6	Below 3,000 feet	3
Site No. 7	Below 3,000 feet	3
Land use/zoning within 1 mile radius:	Commercial or industrial	2
Distance Base boundary:		
Site No. 1	Below 1,000 feet	3
Site No. 2	Below 1,000 feet	3
Site No. 3	Below 1,000 feet	3
Site No. 4	Below 1,000 feet	3
Site No. 5	Below 1,000 feet	3
Site No. 6	Below 1,000 feet	3
Site No. 7	Below 1,000 feet	3
Critical environments within 1 mile:	minor wetlands	2
Water quality of nearest surface water body	Recreation, propagation and management of fish and wildlife	1
Groundwater use of uppermost aquifer:	Drinking water, municipal water available	2
Population served by surface water supply within 3 miles downstream of site:	0	0
Population served by ground-water supply within 3 miles of site:	51 to 1000	2

151st Air Refueling Group
Utah Air National Guard
Salt Lake City International Airport
Salt Lake City, Utah

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

2. WASTE CHARACTERISTICS CATEGORY

Quantity:

Site No. 1	Small quantity	S
Site No. 2	Small quantity	S
Site No. 3	Small quantity	S
Site No. 4	Moderate quantity	M
Site No. 5	Small quantity	S
Site No. 6	Moderate quantity	M
Site No. 7	Moderate quantity	M

Confidence Level:

Site No. 1	Suspected	S
Site No. 2	Confirmed	C
Site No. 3	Suspected	S
Site No. 4	Confirmed	C
Site No. 5	Confirmed	C
Site No. 6	Confirmed	C
Site No. 7	Confirmed	C

Hazard Rating:

Toxicity

Site No. 1	Sax Level 3	3
Site No. 2	Sax Level 3	3
Site No. 3	Sax Level 3	3
Site No. 4	Sax Level 3	3
Site No. 5	Sax level 3	3
Site No. 6	Sax Level 3	3
Site No. 7	Sax Level 3	3

Ignitability

Site No. 1	Flash point above 200°F	0
Site No. 2	Flash point 80°F to 140°F	2
Site No. 3	Flash point 80°F to 140°F	2
Site No. 4	Flash point less than 80°F	3
Site No. 5	Flash point less than 80°F	3
Site No. 6	Flash point 80°F to 140°F	2
Site No. 7	Flash point 80°F to 140°F	2

Radioactivity

Site No. 1	At or below background levels	0
Site No. 2	At or below background levels	0
Site No. 3	At or below background levels	0
Site No. 4	At or below background levels	0
Site No. 5	At or below background levels	0
Site No. 6	At or below background levels	0
Site No. 7	At or below background levels	0

151st Air Refueling Group
Utah Air National Guard
Salt Lake City International Airport
Salt Lake City, Utah

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

Persistence Multiplier:

Site No. 1	Metals, polycyclic compounds and halogenated compounds	1.0
Site No. 2	Metals, polycyclic compounds and halogenated compounds	1.0
Site No. 3	Metals, polycyclic compounds and halogenated compounds	1.0
Site No. 4	Metals, polycyclic compounds and halogenated compounds	1.0
Site No. 5	Metals, polycyclic compounds and halogenated compounds	1.0
Site No. 6	Metals, polycyclic compounds and halogenated compounds	1.0
Site No. 7	Metals, polycyclic compounds and halogenated compounds	1.0

Physical State Multiplier:

Site No. 1	Liquid	1.0
Site No. 2	Liquid	1.0
Site No. 3	Liquid	1.0
Site No. 4	Liquid	1.0
Site No. 5	Liquid	1.0
Site No. 6	Liquid	1.0
Site No. 7	Liquid	1.0

3. PATHWAYS CATEGORY

Surface Water Migration:

Distance to nearest surface water

Site No. 1	0 to 500 feet	3
Site No. 2	0 to 500 feet	3
Site No. 3	0 to 500 feet	3
Site No. 4	0 to 500 feet	3
Site No. 5	0 to 500 feet	3
Site No. 6	0 to 500 feet	3
Site No. 7	0 to 500 feet	3

Net precipitation	+5 to +20 inches	2
Surface erosion	Slight	1
Surface Permeability	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	2
Rainfall intensity	1.0 to 2.0 inches	1
Flooding:	Beyond 100-year flood plain	0

Groundwater Migration:

151st Air Refueling Group
Utah Air National Guard
Salt Lake City International Airport
Salt Lake City, Utah

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

Groundwater Migration:

Depth to groundwater	0 to 10 feet	3
Net precipitation	+5 to +20 inches	2
Soil permeability	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	1
Subsurface flow	Bottom of site located below mean groundwater level	3
Direct access to groundwater	No evidence of risk	0

4. WASTE MANAGEMENT PRACTICES CATEGORY

Practice:	RATING SCALE LEVELS	NUMERICAL VALUE
Site No. 1	No containment	1.0
Site No. 2	Limited containment	0.95
Site No. 3	No containment	1.0
Site No. 4	No containment	1.0
Site No. 5	No containment	1.0
Site No. 6	No containment	1.0
Site No. 7	No containment	1.0

Appendix E

Underground Storage

Tank Inventory

Underground Storage Tank and Oil/Water Separator Inventory, 151 AREFG, Utah Air National Guard,
Salt Lake City International Airport,
Salt Lake City, Utah

Location	Bldg 8	Bldg 18	Bldg 19	Bldg 24-1	Bldg 24-2	Bldg 24-3	Bldg 50	Bldg 1608-1	Bldg 1608-2
Capacity (gallons)	500	150	500	150	150	750	150	2,000	300
Contents	oil/water	grease trap	oil/water	grease trap	grease trap	waste oil	grease trap	MOGAS	oil/water
Year Installed	1969	1959	1962	1972	1972	1972	1983	1955	1985
Material of Construction	concrete	concrete	concrete	concrete	concrete	steel-welded	steel-welded	steel-welded	concrete
Coatings A. Interior B. Exterior	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. paint	A. uncoated B. paint	A. uncoated B. paint	A. uncoated B. uncoated
Cathodic Protection	none	none	none	none	none	none	none	none	none
Status of Tank (year abandoned)	active	active	active	active	active	removed Nov - Dec 1988	active	active	active

Underground Storage Tank and Oil/Water Separator Inventory, 151 AREFG, Utah Air National Guard, Salt Lake City International Airport, Salt Lake City, Utah

Location	Bldg 1624	Bldg 6	Bldg 2015	Bldg 10-1	Bldg 10-2	Bldg 10-3	Bldg 37-1	Bldg 37-2	Bldg 40-1
Capacity (gallons)	300	100	5,000	2,000	2,000	300	2,000	300	2,000
Contents	grease trap	oil/water	waste water	JP-4	diesel fuel	oil/water	fuel oil	oil/water	fuel oil
Year Installed	1980	1984	1979	1950	1950	1950	1979	1979	1980
Material of Construction	concrete	concrete	steel-welded	steel-welded	steel-welded	concrete	steel-welded	concrete	steel-welded
Coatings A. Interior B. Exterior	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. paint	A. uncoated B. paint	A. uncoated B. paint	A. uncoated B. uncoated	A. uncoated B. paint	A. uncoated B. uncoated	A. uncoated B. paint
Cathodic Protection	none	none	none	none	none	none	none	none	sacrificial anode
Status of Tank (year abandoned)	active	active	active	active	active	active	active	active	active

Underground Storage Tank and Oil/Water Separator Inventory, 151 AREFG, Utah Air National Guard,
Salt Lake City International Airport,
Salt Lake City, Utah

Location	Bldg 40-2	Bldg 41-3	POL	POL
Capacity (gallons)	500	4,000	2,000	5,000
Contents	diesel fuel	diesel fuel	JP-4	JP-4
Year Installed	1985	1981	1972	1972
Material of Construction	fiberglass	fiberglass	steel-welded	steel-welded
Coatings A. Interior B. Exterior	A. uncoated B. uncoated	A. uncoated B. uncoated	A. uncoated B. paint	A. uncoated B. paint
Cathodic Protection	sacrificial anode	none	none	none
Status of Tank (year abandoned)	active	active	active	active